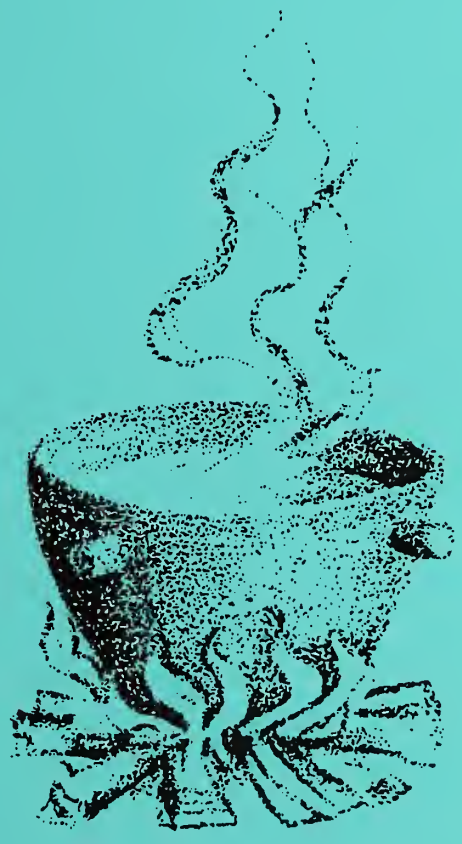
SUGARCANE RESEARCH

Annual Progress Report

1992



Louisiana State University
Agricultural Center
Louisiana Agricultural Experiment Station

SUGARCANE RESEARCH

ANNUAL PROGRESS REPORT

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LOUISIANA AGRICULTURAL EXPERIMENT STATION
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FOREWORD

Research on sugarcane in the Louisiana Agricultural Experiment Station is an integral part of the LSU Agricultural Center's research-extension effort to provide the knowledge and technology base for efficient production and processing of sugarcane. Sugarcane research projects are led by scientists in the Sugar Station/Audubon Sugar Institute, and the departments of: Agricultural Economics and Agribusiness, Agronomy, Biological and Agricultural Engineering, Entomology, and Plant Pathology and Crop Physiology.

Members of the Louisiana Agricultural Experiment Station maintain close working relations with colleagues in respective departments of the College of Agriculture and other colleges of the LSU Baton Rouge campus, the Louisiana Cooperative Extension Service, the Agricultural Research Service and Soil Conservation Service of the USDA, the American Sugar Cane League, and the Louisiana Department of Agriculture and Forestry.

A major portion of the resources for production and processing research are linked to the St. Gabriel Station and Sugar Station/Audubon Sugar Institute respectively. The Iberia Research Station helped to accomplish specific sugarcane research objectives in 1992.

Important parts of the 1992 research effort were conducted on cooperating farms and in cooperating factories throughout the industry. The dwindling of the farm labor supply has been making the evaluation of location effects and location interaction effects increasingly difficult. However, these evaluations are very important and must be continued. **The cooperation of individual farms and sugarcane factories in conducting research projects and financial support of the American Sugar Cane League is gratefully acknowledged.**

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1992 PHOTOPERIOD AND CROSSING IN THE LOUISIANA "L" SUGARCANE VARIETY DEVELOPMENT PROGRAM

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The ultimate success of the Louisiana Sugarcane Variety Development Program depends on the hybridization of desirable clones. Sugarcane does not flower under ambient Louisiana conditions. Photoperiodic adjustments during June through September and night heating during September and October were used to induce and synchronize flowering of desirable genotypes.

Dark chambers were used to impose the photoperiod treatments. The initial treatments were 12.5 h constant day length from the time the chambers were opened in the am until sunset (Table 1). Photoperiodic effects of evening twilight were not considered. After the initial constant day length treatments, day length was shortened by 1 min d^{-1} or 1/2 min d^{-1} until September 10th when all photoperiod adjustments ceased. To prevent overwhelming crossing facilities, two general flowering peaks separated by two weeks were planned. Clonal flowering and pollen production records were used to guide placement of clones on specific bays and carts. Specifically, the **days** from beginning photoperiod treatment **to** appearance of the **first flower** for each clone (DTFF) within treatment were used. The range of estimated DTFF was generally limited to 10 days per cart. To avoid exceeding the 10 day range, easier-to-induce clones were removed from the cart prior to the start date for the cart and returned at its appropriate start date. More difficult to flower clones or those clones with no flowering history were placed with the group scheduled for the late peak and received the longest period of induction treatments (Bay 6). Clones that were to be used as males were placed in heated bays 3 and 4. Most of the cans of easier-to-flower clones were placed in bays 1 through 3 with some cans of most-easy-flowering clones placed in bays 4 through 6. Within each bay, the clones were ordered by DTFF and placed on carts according to days of treatment required. Those requiring the most treatment were placed on cart C and those requiring the least treatment were placed on cart A.

Hurricane Andrew interrupted the photoperiod treatments and caused considerable damage to the crossing greenhouse.

Of the 198 clones grown on photoperiod carts in 1992, 57 were CPs, 13 were LCPs, one was a LHo, 121 were Ls, four were USs and two were of a foreign origin. Three Hundred twenty one cans of 137 clones were subjected to photoperiod treatments. In an attempt to increase the mean genetic worth of the parental population, forty seven clones were discarded after photoperiod treatment and not used in crossing. Of the 90 clones remaining, 70 flowered (Table 2) and were used to produce 159,312 viable seed from 228 crosses (Table 3 to 6). Sixty eight thousand, four hundred viable seed were produced from the 141 biparental crosses.

The seed production for 1992 was below normal. Possible reasons include: damage to the crossing facilities and interruptions of photoperiod treatments caused by hurricane Andrew,

using a reduced number of clones in crossing, personnel changes and budget cuts which resulted in shortage of personnel during the crossing campaign.

Table 1. Summary of 1992 photoperiod treatments.

Bay	Cart	Earliest Start Treatment	Decline		Bay Heat Status	Target Flower Date
			Date Begun	Rate (min d^{-1})		
1	A	June 20	July 10	1	no heat	Sept. 30
1	B	June 17	July 10	1	no heat	Sept. 30
1	C	June 7	July 10	1	no heat	Sept. 30
2	A	June 22	July 15	1	heated	Sept. 30
2	B	June 8	July 15	1	heated	Sept. 30
2	C	May 31	July 15	1	heated	Sept. 30
3	A	June 11	July 15	1	heated	Sept. 30
3	B	June 8	July 15	1	heated	Sept. 30
3	C	May 23	July 15	1	heated	Sept. 30
4	A	June 19	July 19	½	heated	Oct. 14
4	B	June 14	July 19	½	heated	Oct. 14
4	C	May 23	July 19	½	heated	Oct. 14
5	A	June 24	July 29	1	heated	Oct. 14
5	B	June 20	July 29	1	heated	Oct. 14
5	C	June 20	July 29	1	heated	Oct. 14
6	A	June 20	July 29	1	heated	Oct. 14
6	B	June 8	July 29	1	heated	Oct. 14
6	C	May 23	July 29	1	heated	Oct. 14

Table 2. Summary of minimum and mean days to flower by variety and photoperiod treatment.

Variety	Peak	Heat	Decline Rate (min d^{-1})	Days to first flower	Mean days to flower	Pollen rating	Number of tassels
CP65-357	Early	No	1.0	120	120	7.0	1
CP65-357	Late	Yes	1.0	117	117	9.0	1
CP70-321	Late	Yes	0.5	120	124	3.0	2
CP70-330	Early	Yes	1.0	111	114	7.0	6
CP70-330	Early	No	1.0	113	113	5.0	2
CP70-330	Late	Yes	1.0	109	112	7.0	2
CP72-370	Late	Yes	0.5	134	134	5.0	1
CP72-370	Late	Yes	1.0	131	131	1.0	1
CP73-343	Early	Yes	1.0	109	111	1.5	4
CP73-343	Late	Yes	0.5	122	122	3.0	2
CP74-383	Early	No	1.0	93	95	4.5	8
CP74-383	Late	Yes	1.0	102	103	6.8	8
CP75-1082	Early	Yes	1.0	93	93	1.0	2
CP75-1082	Late	Yes	0.5	99	99	3.0	3
CP75-361	Early	Yes	1.0	113	113	9.0	3
CP75-361	Early	No	1.0	113	113	9.0	1
CP76-331	Early	Yes	1.0	91	94	3.0	5
CP76-331	Early	No	1.0	85	86	3.0	2
CP76-331	Late	Yes	0.5	103	104	3.4	6
CP76-351	Early	Yes	1.0	122	123	6.0	4
CP76-351	Late	Yes	0.5	142	142	7.0	1
CP77-310	Early	Yes	1.0	93	94	2.8	6
CP77-310	Late	Yes	0.5	109	111	1.9	7
CP77-405	Early	Yes	1.0	114	117	6.0	2
CP77-407	Early	Yes	1.0	94	95	2.0	6
CP77-407	Late	Yes	0.5	109	114	2.3	7
CP78-317	Early	Yes	1.0	89	89	7.0	2
CP78-317	Late	Yes	0.5	110	110	3.0	2
CP78-357	Early	No	1.0	108	116	5.3	8
CP78-357	Late	Yes	1.0	128	123	5.0	2
CP79-318	Early	Yes	1.0	110	111	4.5	7
CP79-318	Late	Yes	0.5	133	134	3.0	2
CP79-348	Early	No	1.0	97	108	8.0	2
CP79-348	Late	Yes	1.0	100	119	5.0	2
CP82-550	Early	Yes	1.0	104	112	6.6	8
CP83-644	Early	Yes	1.0	139	139	7.0	1

Table 2. continued.

Variety	Peak	Heat	Decline Rate (min d^{-1})	Days to first flower	Mean days to flower	Pollen rating	Number of tassels
CP83-644	Late	Yes	1.0	137	138	6.0	4
CP87-626	Early	Yes	1.0	110	119	5.0	2
CP87-626	Late	Yes	0.5	124	128	3.0	3
CP87-658	Late	Yes	1.0	103	107	2.0	2
CP88-702	Early	Yes	1.0	107	112	1.0	2
CP88-718	Early	Yes	1.0	132	139	2.3	3
CP88-739	Late	Yes	1.0	109	111	6.6	7
CP88-755	Late	Yes	1.0	142	147	5.0	2
CP89-800	Late	Yes	1.0	100	104	7.7	3
CP89-805	Late	Yes	1.0	106	109	2.0	4
CP89-811	Early	No	1.0	83	83	7.0	1
CP89-816	Late	Yes	1.0	100	104	2.0	2
CP89-825	Late	Yes	1.0	130	141	4.0	2
CP89-831	Late	Yes	1.0	114	115	7.0	7
CP89-846	Early	Yes	1.0	115	117	5.5	8
CP89-846	Late	Yes	0.5	127	130	3.0	7
CP89-848	Early	No	1.0	107	113	7.8	6
CP89-855	Late	Yes	1.0	102	104	1.6	7
CP89-879	Early	No	1.0	102	119	6.0	2
CP89-884	Late	Yes	1.0	109	117	6.3	3
CP89-889	Late	Yes	1.0	114	114	3.0	2
LCP81-010	Early	Yes	1.0	95	96	4.5	6
LCP81-010	Late	Yes	0.5	110	113	3.0	6
LCP81-030	Early	Yes	1.0	114	116	3.5	4
LCP82-089	Early	Yes	1.0	131	134	2.8	9
LCP82-089	Late	Yes	0.5	149	151	3.2	9
LCP85-376	Late	Yes	1.0	76	76	9.0	1
LCP85-384	Early	Yes	1.0	103	107	1.8	15
LCP85-384	Late	Yes	0.5	114	118	3.3	21
LCP86-429	Early	No	1.0	98	100	3.5	4
LCP86-454	Late	Yes	0.5	111	111	2.3	3
LCP86-454	Late	Yes	1.0	103	103	1.0	1
LCP87-017	Early	Yes	1.0	93	98	1.4	15
LCP87-017	Late	Yes	0.5	108	111	2.9	14
LCP88-091	Early	Yes	1.0	134	135	3.0	4
LCP88-091	Late	Yes	0.5	135	135	2.0	2

Table 2. continued.

Variety	Peak	Heat	Decline Rate (min d^{-1})	Days to first flower	Mean days to flower	Pollen rating	Number of tassels
LHo83-153	Late	Yes	1.0	144	150	4.0	2
L75-002	Late	Yes	1.0	105	115	7.0	4
L75-056	Early	No	1.0	102	116	9.0	2
L75-056	Late	Yes	1.0	98	100	2.2	5
L78-063	Early	Yes	1.0	101	103	1.9	5
L88-046	Early	Yes	1.0	132	137	7.0	2
L88-046	Late	Yes	0.5	142	142	7.0	1
L88-063	Early	Yes	1.0	135	135	.	1
L88-063	Late	Yes	0.5	146	146	1.0	2
L89-107	Late	Yes	1.0	114	118	8.0	6
L89-113	Early	No	1.0	122	122	5.0	2
L89-113	Late	Yes	1.0	116	118	2.0	2
L90-170	Early	No	1.0	97	97	8.0	8
L90-176	Late	Yes	1.0	102	104	2.0	7
L90-178	Late	Yes	1.0	116	22	5.5	3
L90-181	Early	Yes	1.0	114	114	1.0	6
L90-190	Early	Yes	1.0	101	101	3.0	7
L90-191	Early	No	1.0	118	118	2.0	3
L90-200	Late	Yes	1.0	111	113	5.0	4
L90-204	Early	Yes	1.0	133	133	3.0	1
L90-207	Early	No	1.0	126	126	5.0	1
L90-216	Early	No	1.0	117	118	6.0	2
US77-010	Early	Yes	1.0	124	125	2.0	2
US78-020	Late	Yes	0.5	144	145	1.5	5
US78-026	Early	Yes	1.0	94	102	3.0	6
US80-004	Early	Yes	1.0	107	117	2.0	2
Total							421

Table 3. Crosses and seed made in 1992 sorted by cross number.

Cross	Female	Male	Seed
XL92-001	CP89-811	LCP86-429	13
XL92-002	LCP86-429	LCP86-429	44
XL92-003	CP78-357	CP76-331	1233
XL92-004	CP76-331	CP76-331	1616
XL92-005	L90-170	CP77-310	683
XL92-006	CP77-310	CP77-310	194
XL92-007	LCP86-429	L90-190	248
XL92-008	CP78-317	L90-190	752
XL92-009	CP82-550	L90-190	1281
XL92-010	L90-190	L90-190	925
XL92-011	CP76-351	LCP87-017	3123
XL92-012	CP89-848	LCP87-017	57
XL92-013	CP70-330	LCP87-017	786
XL92-014	LCP87-017	LCP87-017	2337
XL92-015	L90-170	92P1	124
XL92-016	CP74-383	92P1	3026
XL92-017	US78-026	92P1	4830
XL92-018	LCP87-017	92P1	7196
XL92-019	L90-190	92P1	506
XL92-020	CP74-383	92P1	1301
XL92-021	L90-170	CP76-331	31
XL92-022	CP89-846	CP76-331	209
XL92-023	CP89-848	LCP85-384	0
XL92-024	CP89-846	LCP85-384	1432
XL92-025	LCP85-384	LCP85-384	181
XL92-026	CP89-846	CP88-702	1250
XL92-027	CP88-702	CP88-702	187
XL92-028	CP74-383	US80-004	31
XL92-029	US80-004	US80-004	37
XL92-030	CP89-848	CP77-407	0
XL92-031	CP77-407	CP77-407	97
XL92-032	L90-170	CP75-1082	16
XL92-033	CP75-1082	CP75-1082	368
XL92-034	CP78-357	CP77-310	601
XL92-035	CP82-550	LCP81-010	91
XL92-036	CP89-846	LCP81-010	6
XL92-037	LCP81-010	LCP81-010	568
XL92-038	CP79-348	CP77-407	208
XL92-039	CP76-351	CP73-343	1088
XL92-040	CP78-357	CP73-343	1277
XL92-041	CP73-343	CP73-343	91
XL92-042	LCP81-010	LCP85-384	895
XL92-043	CP79-318	LCP87-017	129
XL92-044	CP75-361	LCP87-017	588
XL92-045	CP89-846	L75-056	543
XL92-046	CP82-550	L75-056	81
XL92-047	L75-056	L75-056	38
XL92-048	CP75-361	CP89-816	205
XL92-049	CP83-644	L75-056	1062
XL92-050	CP89-816	CP89-816	258
XL92-051	CP89-800	LCP85-384	34
XL92-052	CP78-317	LCP85-384	68
XL92-053	L89-107	LCP85-384	16
XL92-054	CP78-357	92P2	23
XL92-055	CP79-318	92P2	0
XL92-056	CP75-361	92P2	93
XL92-057	CP74-383	LCP88-091	10
XL92-058	LCP88-091	LCP88-091	117
XL92-059	CP70-330	CP89-855	157
XL92-060	CP89-855	CP89-855	279
XL92-061	CP70-330	L90-176	12
XL92-062	L90-176	L90-176	0
XL92-063	CP70-330	L90-181	231
XL92-064	L90-181	L90-181	428
XL92-065	CP89-879	L90-176	19
XL92-066	L78-063	92P3	5138
XL92-067	CP89-805	92P3	278
XL92-068	L90-176	92P3	177
XL92-069	L90-181	92P3	7554
XL92-070	US78-026	92P3	860
XL92-071	CP89-800	L75-056	0
XL92-072	CP89-846	L75-056	878
XL92-073	CP75-361	L90-176	12
XL92-074	L89-107	L90-176	0
XL92-075	CP79-318	L90-176	323
XL92-076	CP89-848	LCP82-089	0
XL92-077	CP70-330	LCP82-089	252
XL92-078	L88-046	LCP82-089	25
XL92-079	LCP82-089	LCP82-089	1311
XL92-080	CP74-383	CP88-718	83
XL92-081	CP79-318	CP88-718	159
XL92-082	CP78-357	CP88-718	4
XL92-083	CP88-718	CP88-718	45
XL92-084	CP82-550	CP89-855	349
XL92-085	CP78-357	CP89-855	384
XL92-086	CP78-317	CP89-855	82
XL92-087	CP78-317	CP88-702	35
XL92-088	CP76-351	CP88-702	30
XL92-089	LCP85-384	92P4	2132
XL92-090	LCP86-454	92P4	580
XL92-091	LCP87-017	92P4	.
XL92-092	CP73-343	92P4	616
XL92-093	L78-063	92P4	2869
XL92-094	L89-113	92P4	165
XL92-095	CP83-644	LCP85-384	238
XL92-096	CP74-383	LCP85-384	591
XL92-097	L89-107	CP89-855	32
XL92-098	CP74-383	CP89-855	91

Table 3. continued.

Cross	Female	Male	Seed
XL92-099	CP83-644	CP89-805	92
XL92-101	L89-113	LCP86-454	324
XL92-102	CP87-626	LCP86-454	104
XL92-103	CP78-357	LCP86-454	621
XL92-104	LCP86-454	LCP86-454	353
XL92-105	CP88-739	LCP87-017	71
XL92-106	CP83-644	LCP87-017	1084
XL92-107	LCP85-376	LCP87-017	0
XL92-108	LCP88-091	CP89-816	450
XL92-109	CP78-357	CP89-816	127
XL92-110	CP65-357	CP87-658	0
XL92-111	CP74-383	CP87-658	55
XL92-112	CP70-330	CP87-658	161
XL92-113	CP87-658	CP87-658	412
XL92-116	CP75-1082	92P5	2463
XL92-117	L90-200	92P5	1433
XL92-118	CP76-331	92P5	618
XL92-119	L89-113	92P5	1275
XL92-120	CP77-407	92P5	560
XL92-121	LCP81-030	92P5	209
XL92-122	L78-063	92P5	4435
XL92-123	L75-002	LCP82-089	17
XL92-124	CP88-739	LCP82-089	271
XL92-125	CP89-884	LCP82-089	891
XL92-126	CP70-330	LCP85-384	769
XL92-127	CP89-800	LCP85-384	98
XL92-128	CP74-383	CP89-805	297
XL92-129	L75-002	CP89-805	128
XL92-130	CP89-805	CP89-805	697
XL92-131	CP83-644	CP88-718	0
XL92-132	CP82-550	CP88-718	11
XL92-133	CP83-644	LCP88-091	643
XL92-134	CP77-310	92P6	4165
XL92-135	CP77-407	92P6	3510
XL92-136	CP87-626	92P6	4194
XL92-137	LCP81-010	92P6	6188
XL92-138	LCP81-030	92P6	1673
XL92-139	US77-010	92P6	1757
XL92-140	US78-026	92P6	1741
XL92-141	L88-063	92P6	0
XL92-142	CP78-317	92P6	27
XL92-143	L89-107	LCP82-089	23
XL92-144	CP89-846	LCP82-089	679
XL92-145	CP76-331	LCP82-089	105
XL92-146	CP88-739	LCP85-384	425
XL92-147	CP76-331	LCP85-384	1961
XL92-148	CP83-644	LCP85-384	1872
XL92-149	CP89-848	LCP85-384	36
XL92-150	CP79-348	LCP85-384	1421
XL92-152	LCP81-030	LCP87-017	805
XL92-153	CP83-644	LCP87-017	3960
XL92-154	CP77-407	LCP87-017	1722
XL92-155	CP87-658	LCP85-384	336
XL92-156	CP89-889	LCP85-384	3870
XL92-157	CP88-739	LCP85-384	205
XL92-158	CP89-831	LCP85-384	198
XL92-160	L90-200	LCP81-010	679
XL92-161	CP76-351	LCP81-010	0
XL92-163	CP89-848	CP76-331	5
XL92-164	L88-046	CP76-331	0
XL92-165	L90-191	CP76-331	1086
XL92-166	L88-046	CP87-626	0
XL92-167	L90-191	CP87-626	1068
XL92-168	L90-200	CP87-626	374
XL92-169	CP87-626	CP87-626	62
XL92-170	CP89-846	CP77-310	2920
XL92-172	CP70-330	US80-004	120
XL92-173	L90-216	US80-004	671
XL92-174	CP74-383	US80-004	64
XL92-175	US80-004	US80-004	45
XL92-176	CP89-831	CP73-343	100
XL92-177	L90-176	CP79-318	0
XL92-178	L90-178	CP79-318	330
XL92-179	CP89-831	CP79-318	42
XL92-180	CP79-318	CP79-318	174
XL92-181	LHo83-153	LCP82-089	837
XL92-182	CP89-831	LCP82-089	481
XL92-183	L90-191	CP76-331	64
XL92-184	L90-216	CP76-331	762
XL92-185	CP77-405	L90-200	1609
XL92-186	CP82-550	L90-200	0
XL92-187	L90-200	L90-200	403
XL92-188	CP89-831	LCP86-454	0
XL92-189	L88-063	LCP86-454	45
XL92-190	US78-020	92P7	0
XL92-191	US78-026	92P7	1416
XL92-192	LCP88-091	92P7	0
XL92-194	CP89-846	92P7	278
XL92-195	LCP85-384	92P7	3
XL92-196	CP79-348	LCP85-384	463
XL92-197	L90-178	LCP85-384	1411
XL92-198	CP70-330	LCP85-384	636
XL92-199	CP88-739	CP79-318	530
XL92-200	US78-026	CP79-318	0
XL92-201	L88-091	92P8	2262
XL92-202	US78-020	92P8	176
XL92-203	CP70-321	92P8	256
XL92-204	L88-063	92P8	80
XL92-205	CP77-310	92P8	144
XL92-206	L89-846	L90-204	0
XL92-207	L90-204	L90-204	24
XL92-208	CP65-357	CP88-718	43

Table 3. continued.

Cross	Female	Male	Seed
XL92-209	L75-056	CP88-718	14
XL92-210	CP77-405	LCP82-089	988
XL92-211	CP78-357	LCP82-089	493
XL92-212	L90-207	LCP85-384	557
XL92-213	CP88-755	LCP87-017	0
XL92-214	LCP82-089	CP76-331	4365
XL92-215	L75-002	LCP87-017	1455
XL92-216	LHo83-153	92P9	1062
XL92-217	CP72-370	92P9	551
XL92-218	LCP85-384	92P9	610
XL92-219	CP77-407	92P9	352
XL92-220	LCP82-089	CP89-825	0
XL92-221	CP89-825	CP89-825	103
XL92-222	CP78-357	L75-002	223
XL92-223	L75-002	L75-002	11
XL92-224	CP88-739	CP72-370	0
XL92-225	CP89-879	CP72-370	25
XL92-226	CP89-884	CP72-370	34
XL92-227	CP72-370	CP72-370	8
XL92-228	CP79-348	CP72-370	37
XL92-229	CP70-330	CP72-370	0
XL92-230	L75-056	92P10	0
XL92-231	CP72-370	92P10	314
XL92-232	CP78-357	92P10	52
XL92-233	L90-178	92P10	182
XL92-234	CP88-739	LCP81-010	46
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			159310

Table 4. Crosses and seed made in 1992 sorted by female parent.

Cross	Female	Male	Seed
XL92-110	CP65-357	CP87-658	0
XL92-208	CP65-357	CP88-718	43
XL92-203	CP70-321	92P8	256
XL92-229	CP70-330	CP72-370	0
XL92-112	CP70-330	CP87-658	161
XL92-059	CP70-330	CP89-855	157
XL92-077	CP70-330	LCP82-089	252
XL92-126	CP70-330	LCP85-384	769
XL92-198	CP70-330	LCP85-384	636
XL92-013	CP70-330	LCP87-017	786
XL92-061	CP70-330	L90-176	12
XL92-063	CP70-330	L90-181	231
XL92-172	CP70-330	US80-004	120
XL92-227	CP72-370	CP72-370	8
XL92-231	CP72-370	92P10	314
XL92-217	CP72-370	92P9	551
XL92-041	CP73-343	CP73-343	91
XL92-092	CP73-343	92P4	616
XL92-111	CP74-383	CP87-658	55
XL92-080	CP74-383	CP88-718	83
XL92-128	CP74-383	CP89-805	297
XL92-098	CP74-383	CP89-855	91
XL92-096	CP74-383	LCP85-384	591
XL92-057	CP74-383	LCP88-091	10
XL92-028	CP74-383	US80-004	31
XL92-174	CP74-383	US80-004	64
XL92-016	CP74-383	92P1	3026
XL92-020	CP74-383	92P1	1301
XL92-033	CP75-1082	CP75-1082	368
XL92-116	CP75-1082	92P5	2463
XL92-048	CP75-361	CP89-816	205
XL92-044	CP75-361	LCP87-017	588
XL92-073	CP75-361	L90-176	12
XL92-056	CP75-361	92P2	93
XL92-004	CP76-331	CP76-331	1616
XL92-145	CP76-331	LCP82-089	105
XL92-147	CP76-331	LCP85-384	1961
XL92-118	CP76-331	92P5	618
XL92-039	CP76-351	CP73-343	1088
XL92-088	CP76-351	CP88-702	30
XL92-161	CP76-351	LCP81-010	0
XL92-011	CP76-351	LCP87-017	3123
XL92-006	CP77-310	CP77-310	194
XL92-134	CP77-310	92P6	4165
XL92-205	CP77-310	92P8	144
XL92-210	CP77-405	LCP82-089	988
XL92-185	CP77-405	L90-200	1609
XL92-031	CP77-407	CP77-407	97
XL92-154	CP77-407	LCP87-017	1722
XL92-120	CP77-407	92P5	560
XL92-135	CP77-407	92P6	3510
XL92-219	CP77-407	92P9	352
XL92-087	CP78-317	CP88-702	35
XL92-086	CP78-317	CP89-855	82
XL92-052	CP78-317	LCP85-384	68
XL92-008	CP78-317	L90-190	752
XL92-142	CP78-317	92P6	27
XL92-040	CP78-357	CP73-343	1277
XL92-003	CP78-357	CP76-331	1233
XL92-034	CP78-357	CP77-310	601
XL92-082	CP78-357	CP88-718	4
XL92-109	CP78-357	CP89-816	127
XL92-085	CP78-357	CP89-855	384
XL92-211	CP78-357	LCP82-089	493
XL92-103	CP78-357	LCP86-454	621
XL92-222	CP78-357	L75-002	223
XL92-232	CP78-357	92P10	52
XL92-054	CP78-357	92P2	23
XL92-180	CP79-318	CP79-318	174
XL92-081	CP79-318	CP88-718	159
XL92-043	CP79-318	LCP87-017	129
XL92-075	CP79-318	L90-176	323
XL92-055	CP79-318	92P2	0
XL92-228	CP79-348	CP72-370	37
XL92-038	CP79-348	CP77-407	208
XL92-150	CP79-348	LCP85-384	1421
XL92-196	CP79-348	LCP85-384	463
XL92-132	CP82-550	CP88-718	11
XL92-084	CP82-550	CP89-855	349
XL92-035	CP82-550	LCP81-010	91
XL92-046	CP82-550	L75-056	81
XL92-009	CP82-550	L90-190	1281
XL92-186	CP82-550	L90-200	0
XL92-131	CP83-644	CP88-718	0
XL92-099	CP83-644	CP89-805	92
XL92-095	CP83-644	LCP85-384	238
XL92-148	CP83-644	LCP85-384	1872
XL92-106	CP83-644	LCP87-017	1084
XL92-153	CP83-644	LCP87-017	3960
XL92-133	CP83-644	LCP88-091	643
XL92-049	CP83-644	L75-056	1062
XL92-169	CP87-626	CP87-626	62
XL92-102	CP87-626	LCP86-454	104
XL92-136	CP87-626	92P6	4194
XL92-113	CP87-658	CP87-658	412
XL92-155	CP87-658	LCP85-384	336
XL92-027	CP88-702	CP88-702	187
XL92-083	CP88-718	CP88-718	45
XL92-224	CP88-739	CP72-370	0
XL92-199	CP88-739	CP79-318	530
XL92-234	CP88-739	LCP81-010	46
XL92-124	CP88-739	LCP82-089	271

Table 4. continued.

Cross	Female	Male	Seed
XL92-146	CP88-739	LCP85-384	425
XL92-157	CP88-739	LCP85-384	205
XL92-105	CP88-739	LCP87-017	71
XL92-213	CP88-755	LCP87-017	0
XL92-051	CP89-800	LCP85-384	34
XL92-127	CP89-800	LCP85-384	98
XL92-071	CP89-800	L75-056	0
XL92-130	CP89-805	CP89-805	697
XL92-067	CP89-805	92P3	278
XL92-001	CP89-811	LCP86-429	13
XL92-050	CP89-816	CP89-816	258
XL92-221	CP89-825	CP89-825	103
XL92-176	CP89-831	CP73-343	100
XL92-179	CP89-831	CP79-318	42
XL92-182	CP89-831	LCP82-089	481
XL92-158	CP89-831	LCP85-384	198
XL92-188	CP89-831	LCP86-454	0
XL92-022	CP89-846	CP76-331	209
XL92-170	CP89-846	CP77-310	2920
XL92-026	CP89-846	CP88-702	1250
XL92-036	CP89-846	LCP81-010	6
XL92-144	CP89-846	LCP82-089	679
XL92-024	CP89-846	LCP85-384	1432
XL92-045	CP89-846	L75-056	543
XL92-072	CP89-846	L75-056	878
XL92-194	CP89-846	92P7	278
XL92-163	CP89-848	CP76-331	5
XL92-030	CP89-848	CP77-407	0
XL92-076	CP89-848	LCP82-089	0
XL92-023	CP89-848	LCP85-384	0
XL92-149	CP89-848	LCP85-384	36
XL92-012	CP89-848	LCP87-017	57
XL92-060	CP89-855	CP89-855	279
XL92-225	CP89-879	CP72-370	25
XL92-065	CP89-879	L90-176	19
XL92-226	CP89-884	CP72-370	34
XL92-125	CP89-884	LCP82-089	891
XL92-156	CP89-889	LCP85-384	3870
XL92-037	LCP81-010	LCP81-010	568
XL92-042	LCP81-010	LCP85-384	895
XL92-137	LCP81-010	92P6	6188
XL92-152	LCP81-030	LCP87-017	805
XL92-121	LCP81-030	92P5	209
XL92-138	LCP81-030	92P6	1673
XL92-214	LCP82-089	CP76-331	4365
XL92-220	LCP82-089	CP89-825	0
XL92-079	LCP82-089	LCP82-089	1311
XL92-107	LCP85-376	LCP87-017	0
XL92-025	LCP85-384	LCP85-384	181
XL92-089	LCP85-384	92P4	2132
XL92-195	LCP85-384	92P7	3
XL92-218	LCP85-384	92P9	610
XL92-002	LCP86-429	LCP86-429	44
XL92-007	LCP86-429	L90-190	248
XL92-104	LCP86-454	LCP86-454	353
XL92-090	LCP86-454	92P4	580
XL92-014	LCP87-017	LCP87-017	2337
XL92-018	LCP87-017	92P1	7196
XL92-091	LCP87-017	92P4	.
XL92-108	LCP88-091	CP89-816	450
XL92-058	LCP88-091	LCP88-091	117
XL92-192	LCP88-091	92P7	0
XL92-181	LHo83-153	LCP82-089	837
XL92-216	LHo83-153	92P9	1062
XL92-129	L75-002	CP89-805	128
XL92-123	L75-002	LCP82-089	17
XL92-215	L75-002	LCP87-017	1455
XL92-223	L75-002	L75-002	11
XL92-209	L75-056	CP88-718	14
XL92-047	L75-056	L75-056	38
XL92-230	L75-056	92P10	0
XL92-066	L78-063	92P3	5138
XL92-093	L78-063	92P4	2869
XL92-122	L78-063	92P5	4435
XL92-164	L88-046	CP76-331	0
XL92-166	L88-046	CP87-626	0
XL92-078	L88-046	LCP82-089	25
XL92-189	L88-063	LCP86-454	45
XL92-141	L88-063	92P6	0
XL92-204	L88-063	92P8	80
XL92-201	L88-091	92P8	2262
XL92-097	L89-107	CP89-855	32
XL92-143	L89-107	LCP82-089	23
XL92-053	L89-107	LCP85-384	16
XL92-074	L89-107	L90-176	0
XL92-101	L89-113	LCP86-454	324
XL92-094	L89-113	92P4	165
XL92-119	L89-113	92P5	1275
XL92-206	L89-846	L90-204	0
XL92-032	L90-170	CP75-1082	16
XL92-021	L90-170	CP76-331	31
XL92-005	L90-170	CP77-310	683
XL92-015	L90-170	92P1	124
XL92-177	L90-176	CP79-318	0
XL92-062	L90-176	L90-176	0
XL92-068	L90-176	92P3	177
XL92-178	L90-178	CP79-318	330
XL92-197	L90-178	LCP85-384	1411
XL92-233	L90-178	92P10	182
XL92-064	L90-181	L90-181	428
XL92-069	L90-181	92P3	7554
XL92-010	L90-190	L90-190	925

Table 4. continued.

Cross	Female	Male	Seed
XL92-019	L90-190	92P1	506
XL92-165	L90-191	CP76-331	1086
XL92-183	L90-191	CP76-331	64
XL92-167	L90-191	CP87-626	1068
XL92-168	L90-200	CP87-626	374
XL92-160	L90-200	LCP81-010	679
XL92-187	L90-200	L90-200	403
XL92-117	L90-200	92P5	1433
XL92-207	L90-204	L90-204	24
XL92-212	L90-207	LCP85-384	557
XL92-184	L90-216	CP76-331	762
XL92-173	L90-216	US80-004	671
XL92-139	US77-010	92P6	1757
XL92-190	US78-020	92P7	0
XL92-202	US78-020	92P8	176
XL92-200	US78-026	CP79-318	0
XL92-017	US78-026	92P1	4830
XL92-070	US78-026	92P3	860
XL92-140	US78-026	92P6	1741
XL92-191	US78-026	92P7	1416
XL92-029	US80-004	US80-004	37
XL92-175	US80-004	US80-004	45
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			159310

Table 5. Crosses and seed made in 1992 sorted by male parent.

Cross	Female	Male	Seed
XL92-229	CP70-330	CP72-370	0
XL92-227	CP72-370	CP72-370	8
XL92-228	CP79-348	CP72-370	37
XL92-224	CP88-739	CP72-370	0
XL92-225	CP89-879	CP72-370	25
XL92-226	CP89-884	CP72-370	34
XL92-041	CP73-343	CP73-343	91
XL92-039	CP76-351	CP73-343	1088
XL92-040	CP78-357	CP73-343	1277
XL92-176	CP89-831	CP73-343	100
XL92-033	CP75-1082	CP75-1082	368
XL92-032	L90-170	CP75-1082	16
XL92-004	CP76-331	CP76-331	1616
XL92-003	CP78-357	CP76-331	1233
XL92-022	CP89-846	CP76-331	209
XL92-163	CP89-848	CP76-331	5
XL92-214	LCP82-089	CP76-331	4365
XL92-164	L88-046	CP76-331	0
XL92-021	L90-170	CP76-331	31
XL92-165	L90-191	CP76-331	1086
XL92-183	L90-191	CP76-331	64
XL92-184	L90-216	CP76-331	762
XL92-006	CP77-310	CP77-310	194
XL92-034	CP78-357	CP77-310	601
XL92-170	CP89-846	CP77-310	2920
XL92-005	L90-170	CP77-310	683
XL92-031	CP77-407	CP77-407	97
XL92-038	CP79-348	CP77-407	208
XL92-030	CP89-848	CP77-407	0
XL92-180	CP79-318	CP79-318	174
XL92-199	CP88-739	CP79-318	530
XL92-179	CP89-831	CP79-318	42
XL92-177	L90-176	CP79-318	0
XL92-178	L90-178	CP79-318	330
XL92-200	US78-026	CP79-318	0
XL92-169	CP87-626	CP87-626	62
XL92-166	L88-046	CP87-626	0
XL92-167	L90-191	CP87-626	1068
XL92-168	L90-200	CP87-626	374
XL92-110	CP65-357	CP87-658	0
XL92-112	CP70-330	CP87-658	161
XL92-111	CP74-383	CP87-658	55
XL92-113	CP87-658	CP87-658	412
XL92-088	CP76-351	CP88-702	30
XL92-087	CP78-317	CP88-702	35
XL92-027	CP88-702	CP88-702	187
XL92-026	CP89-846	CP88-702	1250
XL92-208	CP65-357	CP88-718	43
XL92-080	CP74-383	CP88-718	83
XL92-082	CP78-357	CP88-718	4
XL92-081	CP79-318	CP88-718	159
XL92-132	CP82-550	CP88-718	11
XL92-131	CP83-644	CP88-718	0
XL92-083	CP88-718	CP88-718	45
XL92-209	L75-056	CP88-718	14
XL92-128	CP74-383	CP89-805	297
XL92-099	CP83-644	CP89-805	92
XL92-130	CP89-805	CP89-805	697
XL92-129	L75-002	CP89-805	128
XL92-048	CP75-361	CP89-816	205
XL92-109	CP78-357	CP89-816	127
XL92-050	CP89-816	CP89-816	258
XL92-108	LCP88-091	CP89-816	450
XL92-221	CP89-825	CP89-825	103
XL92-220	LCP82-089	CP89-825	0
XL92-059	CP70-330	CP89-855	157
XL92-098	CP74-383	CP89-855	91
XL92-086	CP78-317	CP89-855	82
XL92-085	CP78-357	CP89-855	384
XL92-084	CP82-550	CP89-855	349
XL92-060	CP89-855	CP89-855	279
XL92-097	L89-107	CP89-855	32
XL92-161	CP76-351	LCP81-010	0
XL92-035	CP82-550	LCP81-010	91
XL92-234	CP88-739	LCP81-010	46
XL92-036	CP89-846	LCP81-010	6
XL92-037	LCP81-010	LCP81-010	568
XL92-160	L90-200	LCP81-010	679
XL92-077	CP70-330	LCP82-089	252
XL92-145	CP76-331	LCP82-089	105
XL92-210	CP77-405	LCP82-089	988
XL92-211	CP78-357	LCP82-089	493
XL92-124	CP88-739	LCP82-089	271
XL92-182	CP89-831	LCP82-089	481
XL92-144	CP89-846	LCP82-089	679
XL92-076	CP89-848	LCP82-089	0
XL92-125	CP89-884	LCP82-089	891
XL92-079	LCP82-089	LCP82-089	1311
XL92-181	LHo83-153	LCP82-089	837
XL92-123	L75-002	LCP82-089	17
XL92-078	L88-046	LCP82-089	25
XL92-143	L89-107	LCP82-089	23
XL92-126	CP70-330	LCP85-384	769
XL92-198	CP70-330	LCP85-384	636
XL92-096	CP74-383	LCP85-384	591
XL92-147	CP76-331	LCP85-384	1961
XL92-052	CP78-317	LCP85-384	68
XL92-150	CP79-348	LCP85-384	1421
XL92-196	CP79-348	LCP85-384	463
XL92-095	CP83-644	LCP85-384	238
XL92-148	CP83-644	LCP85-384	1872
XL92-155	CP87-658	LCP85-384	336

Table 5. continued.

Cross	Female	Male	Seed
XL92-146	CP88-739	LCP85-384	425
XL92-157	CP88-739	LCP85-384	205
XL92-051	CP89-800	LCP85-384	34
XL92-127	CP89-800	LCP85-384	98
XL92-158	CP89-831	LCP85-384	198
XL92-024	CP89-846	LCP85-384	1432
XL92-023	CP89-848	LCP85-384	0
XL92-149	CP89-848	LCP85-384	36
XL92-156	CP89-889	LCP85-384	3870
XL92-042	LCP81-010	LCP85-384	895
XL92-025	LCP85-384	LCP85-384	181
XL92-053	L89-107	LCP85-384	16
XL92-197	L90-178	LCP85-384	1411
XL92-212	L90-207	LCP85-384	557
XL92-001	CP89-811	LCP86-429	13
XL92-002	LCP86-429	LCP86-429	44
XL92-103	CP78-357	LCP86-454	621
XL92-102	CP87-626	LCP86-454	104
XL92-188	CP89-831	LCP86-454	0
XL92-104	LCP86-454	LCP86-454	353
XL92-189	L88-063	LCP86-454	45
XL92-101	L89-113	LCP86-454	324
XL92-013	CP70-330	LCP87-017	786
XL92-044	CP75-361	LCP87-017	588
XL92-011	CP76-351	LCP87-017	3123
XL92-154	CP77-407	LCP87-017	1722
XL92-043	CP79-318	LCP87-017	129
XL92-106	CP83-644	LCP87-017	1084
XL92-153	CP83-644	LCP87-017	3960
XL92-105	CP88-739	LCP87-017	71
XL92-213	CP88-755	LCP87-017	0
XL92-012	CP89-848	LCP87-017	57
XL92-152	LCP81-030	LCP87-017	805
XL92-107	LCP85-376	LCP87-017	0
XL92-014	LCP87-017	LCP87-017	2337
XL92-215	L75-002	LCP87-017	1455
XL92-057	CP74-383	LCP88-091	10
XL92-133	CP83-644	LCP88-091	643
XL92-058	LCP88-091	LCP88-091	117
XL92-222	CP78-357	L75-002	223
XL92-223	L75-002	L75-002	11
XL92-046	CP82-550	L75-056	81
XL92-049	CP83-644	L75-056	1062
XL92-071	CP89-800	L75-056	0
XL92-045	CP89-846	L75-056	543
XL92-072	CP89-846	L75-056	878
XL92-047	L75-056	L75-056	38
XL92-061	CP70-330	L90-176	12
XL92-073	CP75-361	L90-176	12
XL92-075	CP79-318	L90-176	323
XL92-065	CP89-879	L90-176	19
XL92-074	L89-107	L90-176	0
XL92-062	L90-176	L90-176	0
XL92-063	CP70-330	L90-181	231
XL92-064	L90-181	L90-181	428
XL92-008	CP78-317	L90-190	752
XL92-009	CP82-550	L90-190	1281
XL92-007	LCP86-429	L90-190	248
XL92-010	L90-190	L90-190	925
XL92-185	CP77-405	L90-200	1609
XL92-186	CP82-550	L90-200	0
XL92-187	L90-200	L90-200	403
XL92-206	L89-846	L90-204	0
XL92-207	L90-204	L90-204	24
XL92-172	CP70-330	US80-004	120
XL92-028	CP74-383	US80-004	31
XL92-174	CP74-383	US80-004	64
XL92-173	L90-216	US80-004	671
XL92-029	US80-004	US80-004	37
XL92-175	US80-004	US80-004	45
XL92-016	CP74-383	92P1	3026
XL92-020	CP74-383	92P1	1301
XL92-018	LCP87-017	92P1	7196
XL92-015	L90-170	92P1	124
XL92-019	L90-190	92P1	506
XL92-017	US78-026	92P1	4830
XL92-231	CP72-370	92P10	314
XL92-232	CP78-357	92P10	52
XL92-230	L75-056	92P10	0
XL92-233	L90-178	92P10	182
XL92-056	CP75-361	92P2	93
XL92-054	CP78-357	92P2	23
XL92-055	CP79-318	92P2	0
XL92-067	CP89-805	92P3	278
XL92-066	L78-063	92P3	5138
XL92-068	L90-176	92P3	177
XL92-069	L90-181	92P3	7554
XL92-070	US78-026	92P3	860
XL92-092	CP73-343	92P4	616
XL92-089	LCP85-384	92P4	2132
XL92-090	LCP86-454	92P4	580
XL92-091	LCP87-017	92P4	.
XL92-093	L78-063	92P4	2869
XL92-094	L89-113	92P4	165
XL92-116	CP75-1082	92P5	2463
XL92-118	CP76-331	92P5	618
XL92-120	CP77-407	92P5	560
XL92-121	LCP81-030	92P5	209
XL92-122	L78-063	92P5	4435
XL92-119	L89-113	92P5	1275
XL92-117	L90-200	92P5	1433
XL92-134	CP77-310	92P6	4165

Table 5. continued.

Cross	Female	Male	Seed
XL92-135	CP77-407	92P6	3510
XL92-142	CP78-317	92P6	27
XL92-136	CP87-626	92P6	4194
XL92-137	LCP81-010	92P6	6188
XL92-138	LCP81-030	92P6	1673
XL92-141	L88-063	92P6	0
XL92-139	US77-010	92P6	1757
XL92-140	US78-026	92P6	1741
XL92-194	CP89-846	92P7	278
XL92-195	LCP85-384	92P7	3
XL92-192	LCP88-091	92P7	0
XL92-190	US78-020	92P7	0
XL92-191	US78-026	92P7	1416
XL92-203	CP70-321	92P8	256
XL92-205	CP77-310	92P8	144
XL92-204	L88-063	92P8	80
XL92-201	L88-091	92P8	2262
XL92-202	US78-020	92P8	176
XL92-217	CP72-370	92P9	551
XL92-219	CP77-407	92P9	352
XL92-218	LCP85-384	92P9	610
XL92-216	LHo83-153	92P9	1062
			===
			159310

Table 6. Summary of crosses and seed made in 1992.

Crosstype	No.	Fuzz produced		Germination	Viable seed	
		mean	sum	mean	mean	sum
		------- g -------		no. g^{-1}	--------- no -------	
Selfs	31	8.28	256.7	40.6	368.2	11415
Poly	54	8.35	451.0	158.4	1471.4	79454
Biparental	141	6.13	864.2	73.0	485.4	68443
Total	226	6.96	1571.8	88.2	704.9	159312

1992 LINE TRIAL TESTING, SELECTION AND ASSIGNMENTS LOUISIANA, "L", SUGARCANE VARIETY DEVELOPMENT PROGRAM

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Budget cuts and restrictions, Hurricane Andrew and poor stands that resulted from using frozen seedcane planted in 1991 challenged breeding program personnel in 1992. These difficulties and an increased selection pressure for high sucrose cane varieties coupled to halve typical advancements to the second line trial and increase stages. The numbers of clones advanced in the other stages were typical for the breeding program. Cane was heavily lodged and the crossing house was seriously damaged by the late August storm. The hurricane force winds did enhance selection efforts against brittle cane varieties.

Each year the Louisiana, "L", Sugarcane Variety Development Program conducts a 13 stage project aimed at developing improved sugarcane cultivars for the Louisiana sugarcane industry (Table 3). A summary of the number of experimental clones in the various stages of selection and testing are summarized in Tables 1 and 2.

Hurricane Andrew's lodging effect on the seedling stage cane caused us to use a cane harvester to cut rows of seedlings after the single stools on a particular row were selected. Seedlings are normally selected in September but since the cane was being machine harvested, we had to wait until November to select because the harvested cane was to be shipped to the mill. An average of 36.3% of the initially selected seedlings from the 1990 crossing series were dropped for inadequate Brix (Table 1). With a few exceptions, single stool selections with hand punched Brix values greater than or equal to 21% were advanced to the first line trials. When only a small number of initial selections were made (<10) in family, all selections were commonly advanced without selection for high Brix. Insufficient time and planting space prevented selection among all the seedling available. No family selection for any trait was practiced among the seedlings.

Although we selected lightly against lodged clones in the first line trials, broken stalks due to hurricane force winds and or the sugarcane borer coupled with rigorous selection against low sucrose varieties contributed to a low number of clones being advanced to the second line trials (Tables 1 and 4). Note that low stalk number remained, as usual, the primary reason for dropping a clone. Cane yield rating is primarily based upon stalk number. Thus the 1135 clones dropped due to low ratings were mostly because of low stalk number.

Advancements from the second line trial and the increase stage was greatly hindered because of stand problems (Table 5). This was due to early November, 1991 freezes that partially killed the seed-cane prior to planting. Advancement from the second line and the increase stage was hence heavily dependent on minimal presence of seed-cane to enable planting the next stage. This is not necessarily the same as selection for clones with the ability to produce high stalk numbers and is more likely indirect selection for clones that retain their leaves.

Assignments were based upon data from the first line first ratoon crop, and the plant cane and first ratoon crops of the second line trial (Table 6). Sixty-seven "92" assignments were made and planted into replicated nursery trials (Tables 1, 3 and 6). Use of the 1991 freeze damaged seed-cane in the light soil increase test caused a stand failure. Thus the inavailability of seed-cane allowed only two replicated nurseries of the 92 assignments to be planted compared to the usual three.

Table 1. Summary of selections, advancements and assignments made during 1992 by the Louisiana, "L", Sugarcane Variety Development Program personnel.

Crossing series	Crosses	Seedlings surviving trans-planting	Over-wintered	Advanced to 1st line	Advanced to 2nd line	Advanced to Increase	Assigned
	----------	----------	----------	number of clones	----------	----------	----------
87	227	71507	54495	2331	583	286	67[a]
88	252	64642	28546	4612	777	160[a]	
89	192	63788	62703	2666	431[a]		
90	243	51982[c]	48687	3555[ab]			
91	163	55625[ad]					

a Work performed in 1992.
b Approximately 3000 seedlings were not selected. Among initially selected seedlings, 36.3% were dropped for low Brix.
c Does not include 13970 seedlings from 259 crosses in a replicated cross appraisal test.
d Does not include 13760 seedlings from 215 crosses in a replicated cross appraisal test.

Table 2. Number of "L" clones by assignment series in stages of advancement after assignment.

Year of number assignment (assignment series)							
85	86	87	88	89	90	91	92
----------	----------	----------	----------	number of clones	----------	----------	----------
1	1	2	2	6	17	36	67

Table 3. Outline of LSU breeding program - as of fall 1992.

Year	Stage	Clones	Locations	Reps/Loc	Crops	Major Emphasis of Stage
		---------- number ----------				
1	Crossing		1			Avoid poor crosses; make crosses with high midparent averages, good percent advancement and cross appraisal data.
2	Seedling	55625[a]	1	1	1st ratoon	stalk quality (length, diameter, not- pithy, hollowness, cracked, brittle, big budded etc.), Brix, pest res. (borers, smut, mosaic), stalk no., winter hardiness.
3	1st clonal	3555	1	1	2	stalk quality; sugar content; lodging, pest resistance.
4	2nd clonal	431	1	1	3	sugar yield, stalk quality; sugar content; lodging, pest resistance.
5	Increase	160	2[b]	2	1	same.
6	Nursery	67	3[b,c]	2	3-4	sugar yield, sugar content, lodging, brittleness, pest res., general adaptation.
7	Infield; Nursery replant	36	1[d] 3[e]	2	3	sugar yield, sugar content, pest res., general adaptation, mechanical harvestability.
8	Infield replant	17	3[b,f]	2-3	3	same; 1st year used as parent.
9	Outfield intro.	6	12	1	3	same
10	Outfield	2	12	3	3	same
11	Outfield	2	12	3	3	same
12	Outfield	1	12	3	3	same
13	Outfield	1	12	3	3	same
14	Release	0				

a Does not inlude 13760 seedlings in a cross appraisal test.

b St. Gabriel light and heavy soils. c - Iberia Res. Stn. d - St. Gabriel heavy soil. e - Westfield Pltn., Peebles Pltn., Stoute Farms. f - Ardoyne Farm.

Table 4. Reasons and frequencies for dropping clones from the 1989 crossing series first clonal trail[a].

	Stage 1									
		Rating						Fault		
	Initial clones	2	3	4	5	6	7	9	smut	Dropped from stage 1	Advanced[b] to stage 2
no.	2865	1	1	88	1531	907	202	26	109	1151	1714
%	100	0.0	0.0	3.1	53.4	31.7	7.1	0.9	3.8	40.2	59.8

	Stage 2										
		Fault[c]									
	Initial stage 2 clones	bored	broken stalks	lodged	hollow stalk	low stalk no.	pithy stalk	short stalk	smut	Dropped from stage 2	Advanced to stage 3
no.	1714	40	164	76	41	2	166	2	8	496	1122
%	59.8[d]	8.1	33.1	15.3	8.3	0.4	33.5	0.4	1.6	17.3[d]	39.2[d]

	Stage 3			
	Initial stage 3 clones	low Brix	Advanced	Advanced to 2nd line stage
no.	1122	691	691	431
%	39.2[d]	61.6	24.1[d]	15.0[d]

a Selection among first line trial clones consists of three selection stages, first based upon cane rating or presence of smut, second based upon plot or stalk qualities and third based upon hand punch based Brix.

b To advance to the 2nd selection stage clones must rate ≤ 5 and have no smut.

c Three clones had two faults thus percentages sum to more than 100.

d Percentage is based on initial number in stage 1.

Table 5. Reasons and frequencies for dropping clones from the 1988 crossing series second line trail[a].

	Initial no.	Faults								Dropped clones
		low stalk no.	broken stalks	lodged	pithy stalk	short stalk	smut	hollow stalk	low Brix	
no.	777	323	31	56	123	16	2	13	218	617
%	100	41.5	4.0	7.2	15.8	2.1	0.3	1.7	28.1	79.4

a Selection occurred in three stages. Stage one selection was based upon stalk no. and smut susceptibility. The second stage used stalk quality and the third stage used Brix as selection criteria.

Table 6. Summary of data used to assign varieties permanent numbers in the 1987 crossing series.

Variety	Cross	Female	Male	Sugar[a] yield	Cane[a] yield	Sugar[b] content	Stalk[b] wt.	Stalk[a] no.
				lbs/A	tons/A	lbs/ton	lbs	no./A
CP70-321				2926	12.3	218	1.7	11364
L92-291	XL84-288	CP81-338	CP76-301	9033	35.8	240	2.3	32216
L92-292	XL84-288	CP81-338	CP76-301	10543	40.3	242	2.0	38115
L92-293	XL87-122	CP81-332	LCP81-010	7129	31.1	231	2.0	33275
L92-294	XL85-186	CP70-330	CP77-407	5640	23.4	226	1.8	25410
L92-295	XL87-MISC			6271	26.8	218	2.1	30704
L92-296	XL83-188	CP52-068	CP62-258	11016	46.1	245	2.4	35695
L92-297	XL84-288	CP81-338	CP76-301	7838	31.7	223	2.5	25713
L92-298	XL84-288	CP81-338	CP76-301	6073	26.4	229	2.4	23746
L92-299	XL87-107	CP74-383	LCP81-030	6817	27.3	241	1.9	28133
L92-300	XL87-192	LCP83-137	CP80-323	7723	34.1	214	2.3	28132
L92-301	XL87-192	LCP83-137	CP80-323	6181	25.5	235	2.2	23293
L92-302	XL87-MISC			8014	36.6	204	2.5	30250
L92-303	XL84-288	CP81-338	CP76-301	5087	20.2	243	2.1	24805
L92-304	XL84-288	CP81-338	CP76-301	5785	22.5	251	2.0	22688
L92-305	XL84-226	CP81-338	LCP81-030	7100	27.8	240	3.1	18906
L92-306	XL87-107	CP74-383	LCP81-030	7313	30.6	222	2.6	19511
LHo92-307	XX87-3010	LCP81-010	CP82-513	9632	37.9	245	2.1	33275
L92-308	XL87-122	CP81-332	LCP81-010	6017	22.6	252	2.1	27527
L92-309	XL84-226	CP81-338	LCP81-030	6898	26.9	249	2.6	25864
L92-310	XL84-288	CP81-338	CP76-301	5744	24.5	221	2.6	20419

Table 6. continued.

Variety	Cross	Female	Male	Sugar[a] yield	Cane[a] yield	Sugar[b] content	Stalk[b] wt.	Stalk[a] no.
L92-311	XL87-360	L85-294	L78-035	6155	26.1	228	1.5	34183
L92-312	XL84-288	CP81-338	CP76-301	5533	22.9	223	1.5	32519
L92-313	XL87-136	CP72-355	CP72-355	4600	18.5	225	1.5	29796
LHo92-314	XX87-3169	CP79-332	US82-031	9322	38.7	232	2.2	36603
L92-315	XL84-264	CP78-357	L75-002	6792	26.3	236	1.7	38418
L92-316	XL87-MISC			6217	24.4	224	1.6	27074
L92-317	XL87-180	CP70-300	US77-010	7024	29.7	224	2.3	30704
L92-318	XL87-242	LCP83-153	LCP81-030	6628	26.3	227	2.0	27679
L92-319	XL87-328	LCP82-073	LCP85-371	10426	43.5	227	2.4	34787
L92-320	XL87-199	CP70-300	L84-261	5365	20.6	241	1.8	29040
L92-321	XL87-120	CP70-300	L78-063	6585	26.6	223	2.3	22536
L92-322	XL84-034	CP75-1322	CP77-310	6811	26.0	253	1.8	25410
L92-323	XL84-034	CP75-1322	CP77-310	6110	23.9	227	1.6	28586
L92-324	XL87-207	CP77-407	87P3	5983	22.5	237	2.0	20721
L92-325	XL85-123	CP80-313	CP69-373	5663	23.7	229	2.0	27528
L92-326	XL84-034	CP75-1322	CP77-310	6305	27.4	209	1.9	24352
L92-327	XL87-057	CP75-327	CP77-402	5518	26.4	214	1.8	29191
L92-328	XL83-159	CP79-332	CP77-310	5159	21.5	223	1.4	31006
L92-329	XL83-159	CP79-332	CP77-310	5857	25.6	217	2.1	24956
L92-330	XL87-204	CP70-321	CP73-343	7097	29.6	227	2.4	25864
L92-331	XL87-106	CP65-357	LCP81-030	5681	23.8	225	2.4	23595
L92-332	XL83-099	CP70-330	CP78-321	5492	21.9	228	2.0	24503
L92-333	XL84-268	CP80-356	CP78-403	5957	25.6	225	2.0	31309
L92-334	XL87-056	CP65-357	CP77-402	6412	26.9	233	2.2	22687
L92-335	XL87-347	CP79-318	LCP85-371	8018	32.0	238	2.1	35393
L92-336	XL87-283	LCP81-010	L84-261	7844	34.2	205	2.5	26469
L92-337	XL87-083	L78-063	87P2	6929	27.2	248	1.9	34183
L92-338	XL87-243	CP72-370	L84-262	5649	22.6	229	1.8	24200
L92-339	XL87-338	CP71-357	L78-035	5591	24.8	203	2.0	20267
L92-340	XL87-074	CP77-405	CP76-331	5058	21.9	226	2.1	15277
L92-341	XL87-343	CP74-383	LCP85-313	7702	28.6	260	2.3	17394

Table 6. continued.

Variety	Cross	Female	Male	Sugar[a] yield	Cane[a] yield	Sugar[b] content	Stalk[b] wt.	Stalk[a] no.
L92-342	XL83-127	CP72-355	CP67-412	5689	23.3	232	2.1	22990
L92-343	XL87-338	CP71-357	L78-035	7609	31.2	212	1.8	27528
L92-344	XL85-220	CP80-351	LCP81-030	7971	34.2	222	2.2	28284
L92-345	XL87-338	CP71-357	L78-035	7560	33.6	208	2.0	25410
L92-346	XL85-214	CP80-352	CP76-301	6117	28.3	185	1.7	22990
L92-347	XL87-256	LCP84-215	LCP81-030	6048	27.2	199	1.8	22990
L92-348	XL84-288	CP81-338	CP76-301	8718	37.1	228	2.1	22839
L92-349	XL85-232	LCP82-033	CP77-310	7742	29.1	263	1.6	29948
L92-350	XL87-343	CP74-383	LCP85-313	8478	37.5	231	2.0	31158
L92-351	XL84-288	CP81-338	CP76-301	8000	31.7	232	2.0	22688
L92-352	XL85-258	CP80-323	CP73-351	6255	25.5	243	2.0	20419
L92-353	XL83-176	CP80-352	CP72-355	11492	51.2	221	2.1	40989
L92-354	XL87-243	CP72-370	L84-262	6109	24.4	231	1.6	31309
L92-355	XL85-258	CP80-323	CP73-351	6590	27.6	212	1.7	29494
L92-356	XL84-216	L78-035	CP62-258	9254	39.9	230	2.0	37813
L92-357	XL84-216	L78-035	CP62-258	4935	19.1	253	1.8	26318
$MSD_{0.05}$				3335	13.0	59	0.5	12905

a Based upon plant cane and first ratoon second line trial data (two observations).

b Based upon plant cane and first ratoon second line trial data, and first ratoon first line trial data (three observations).

1992 LOUISIANA (L) NURSERY VARIETY TRIALS

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Five years after the initial hybridization of parents, clones that have met or exceeded criteria for important characteristics at each selection stage are assigned permanent numbers by the Louisiana (L) Sugarcane Variety Development Program. These varieties are planted in replicated single row "nursery" tests.

One of the objectives of the nursery stage of the selection program is to identify and select varieties that will perform well across the range of environments a commercial variety will probably encounter in Louisiana. Three tests are planted in the year of assignment and three additional tests are planted the year after assignment (Table 1). A new test was added at the Danny Stoute Farm near Cecilia, LA in 1992.

Nursery trials were planted in single row (six-foot centers), 16 foot long plots using two replications per location in a randomized complete block design. Three commercial check varieties (CP65-357, CP70-321, and CP74-383) were included in all tests (LCP82-089 replaced CP65-357 in those tests planted in 1992) for comparison basis.

Stalk counts were made in August. During the normal harvest season, ten-stalk samples were harvested by hand for stalk weight and juice analysis. Brix was measured by refractometer and sucrose by polarization. Theoretical recoverable sugar (reported as sucrose content) was calculated according to Gravois and Milligan (1992) assuming a 12.5% fiber when fiber was not available. Cane yield was estimated as the product of stalk weight and stalk number. Sucrose yield was calculated as the product of sucrose content and cane yield.

Analysis of variance was performed for each assigned series, crop and location-soil texture combination. A combined analysis was performed over locations-soil texture for each assignment series. Minimum significant differences (MSD) were calculated by the Waller-Duncan multiple range test (SAS, 1985).

References:

Gravois, K.A. and S.B. Milligan. 1992. Genetic relationships between fiber and sugarcane yield components. Crop Sci. 32: 62-66.

SAS Institute Inc. SAS User's Guide: Statistics, Ver. 5 ed. Cary, NC: SAS Institute Inc., 1985 956pp.

1 Iberia Res. Stn. 2 St. Gabriel Res. Stn. 3 Agronomy Dept. 4 Sugar Stn.

Table 1. Planting and harvest dates of nursery tests planted or harvested in 1992.

Series	Location	Soil Texture[1]	Planting Date	Harvest Dates 1990	1991	1992	Varieties[2] No. Planted	No. Harvest	Table No.
1989	Iberia	B.s.c.	10/19/89	11/27	11/5	10/15	72	9	2
1989	St. Gabriel	S.c.	10/24/89	12/10	10/22	10/20	72	9	3
1989	St. Gabriel	C.s.l.*	10/25/89	12/10	11/16	10/20	72	9	4
1989	Peebles Pltn.	Galvez	10/11/90		11/5	11/3	57	11	6
1990	Iberia	B.s.c.	10/17/90		11/25	11/17	68	18	7
1990	St. Gabriel	S.c.	10/16/90		11/14	12/9	68	20	8
1990	St. Gabriel	C.s.l.	10/18/90		ns	10/20	68	20	9
1990	Peebles Pltn.	J.s.l.	09/18/91			11/30	42	20	11
1990	Westfield Pltn.	S.s.c.	10/15/91			12/3	42	20	12
1991	Iberia	B.s.c.	10/11/91			12/10	65	39	14
1991	St. Gabriel	S.c.	11/15/91			12/1	65	39	15
1991	St. Gabriel	C.s.l.	11/16/91			12/1*	65		
1991	Peebles Pltn.	Galvez	9/11/92				39		
1991	Stoute Farm	B.s.c.	8/20/92				39		
1991	Westfield Pltn.	S.s.c.	10/5/92				39		
1992	Iberia	B.s.c.	10/26/92				67		
1992	St. Gabriel	S.c.	10/26/92				70		

[1] B.s.c. - Baldwin silty clay; C.s.l. - Commerce silt loam; Co. s. l. - Coteau silt loam; Galvez - Galvez silt loam; J.s.l. - Jeanerette silt loam; S.c. - Sharkey clay; S.s.c. - Sharkey silty clay.

[2] Number of varieties per replication including three commercial checks.

* Sampled for stalk weight only.

ns not sampled.

Table 2. 1992 second ratoon means of the 1989 "L" series at the Iberia Research Station.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk number	Stalk weight
	lbs/A	tons/A	lbs/ton	no/A	lbs
CP65-357	8745	35.8	243	39250	1.81
CP70-321	5932	21.5	277	30175	1.46
CP74-383	7764	31.5	246	42426	1.47
LCP89-106	9812	41.4	237	41746	1.99
L89-107	9167	37.5	246	42199	1.73
L89-113	7257	28.1	236	42199	1.33
L89-115	8107	34.0	241	43560	1.55
L89-137	7419	32.5	229	47871	1.35
L89-152	7638	29.4	261	47417	1.24
$MSD_{.05}$	NS	NS	18	NS	0.95

Table 3. 1992 second ratoon means of the 1989 "L" series at the St. Gabriel Research Station on a Sharkey clay.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk number	Stalk weight
	lbs/A	tons/A	lbs/ton	no/A	lbs
CP65-357	7460	27.3	275	31990	1.66
CP70-321	6456	23.8	273	31763	1.50
CP74-383	2849	10.5	272	17243	1.27
LCP89-106	8392	31.5	268	36527	1.72
L89-107	7325	30.1	243	51728	1.19
L89-113	8892	34.0	262	43333	1.57
L89-115	5618	19.9	283	36300	1.10
L89-137	8077	31.2	257	51047	1.21
L89-152	5598	19.4	290	37888	1.02
$MSD_{.05}$	4328	15.2	18	17989	0.65

Table 4. 1992 second ratoon means of the 1989 "L" series at the St. Gabriel Research Station on a Commerce silt loam.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk number	Stalk weight
	lbs/A	tons/A	lbs/ton	no/A	lbs
CP65-357	7519	28.5	267	34258	1.66
CP70-321	10686	37.0	290	45602	1.62
CP74-383	7884	30.7	258	40611	1.52
LCP89-106	12019	48.7	247	50593	1.93
L89-107	9069	37.2	244	51047	1.47
L89-113	11225	43.8	257	46963	1.88
L89-115	10674	41.6	257	50820	1.70
L89-137	8466	33.9	251	47871	1.43
L89-152	7443	26.6	280	34485	1.59
$MSD_{.05}$	3271	13.6	29	24387	NS

Table 5. 1992 second ratoon means of the 1989 "L" series across locations[1].

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk number	Stalk weight
	lbs/A	tons/A	lbs/ton	no/A	lbs
CP65-357	7908	30.5	261	35166	1.71
CP70-321	7691	27.4	280	35847	1.52
CP74-383	6166	24.2	258	33427	1.42
LCP89-106	10074	40.5	251	42955	1.88
L89-107	8520	34.9	244	48325	1.46
L89-113	9498	35.3	255	44165	1.59
L89-115	8133	31.8	260	43560	1.45
L89-137	7987	32.5	246	48929	1.33
L89-152	6893	25.1	277	39930	1.28
$MSD_{.05}$	2799	11.5	16	14187	0.30

[1] Iberia Research Station, St. Gabriel Sharkey clay and Commerce silt loam.

Table 6. 1992 first ratoon means of the 1989 "L" series at Peebles Plantation.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk number	Stalk weight
	lbs/A	tons/A	lbs/ton	no/A	lbs
CP65-357	6637	23.2	287	26091	1.77
CP70-321	7194	24.6	293	30629	1.61
CP74-383	8765	30.5	289	38569	1.57
L87-017	10929	40.7	269	49005	1.66
L87-491	9740	34.6	282	43560	1.60
LCP89-106	8150	32.3	252	44014	1.47
L89-107	9199	33.6	274	46056	1.47
L89-113	8850	33.4	266	35393	1.89
L89-115	9274	34.5	270	41065	1.68
L89-137	6440	24.2	267	37435	1.30
L89-152	10044	33.3	302	47871	1.39
$MSD_{.05}$	3161	10.5	31	11804	0.28

Table 7. 1992 first ratoon means of the 1990 "L" series at the Iberia Research Station.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk number	Stalk weight	Fiber
	lbs/A	tons/A	lbs/ton	no/A	lbs	%
CP65-357	11325	41.4	275	39023	2.12	13.3
CP70-321	11160	39.5	283	36527	2.17	11.6
CP74-383	16088	62.3	261	51955	2.40	12.1
L90-170	8525	32.8	264	40838	1.60	14.1
L90-171	10480	38.6	273	39477	1.98	13.8
L90-178	13141	43.6	301	54904	1.59	15.8
L90-188	11436	40.1	284	39703	2.03	13.5
L90-190	10498	40.1	263	43560	1.85	13.1
L90-191	10347	38.1	272	43560	1.75	13.8
L90-194	12217	44.8	273	36754	2.44	12.9
LCP90-198	12078	45.9	264	42426	2.16	14.7
L90-200	13644	47.8	283	44695	2.12	14.6
L90-204	11255	42.4	272	49459	1.68	14.8
L90-207	8948	35.9	251	44922	1.60	15.7
L90-208	13646	46.7	292	51501	1.81	13.7
L90-216	10326	46.8	222	42653	2.22	13.8
L90-218	12247	45.1	272	43107	2.10	14.1
L90-223	11617	49.1	237	55811	1.76	18.1
$MSD_{.05}$	6372	27.5	70	11886	1.07	2.2

Table 8. 1992 first ratoon means of the 1990 "L" series at the St. Gabriel Research Station on a Sharkey clay.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk number	Stalk weight	Fiber
	lbs/A	tons/A	lbs/ton	no/A	lbs	%
CP65-357	5496	18.9	292	26545	1.42	12.5
CP70-321	4460	15.1	296	18150	1.62	11.5
CP74-383	7426	27.8	266	29948	1.83	11.5
L90-170	6463	22.9	283	30855	1.49	13.2
L90-171	5656	21.4	265	26091	1.64	12.7
L90-176	5981	22.0	270	44922	0.97	14.7
L90-178	10605	35.0	303	41519	1.68	12.8
L90-181	6955	28.3	247	36074	1.59	12.8
L90-188	8966	32.7	266	32217	1.97	11.8
L90-190	9126	36.7	248	44695	1.64	12.2
L90-191	7301	26.4	276	34712	1.52	13.8
L90-194	8091	29.0	284	30855	1.85	11.6
LCP90-198	5783	22.5	261	30855	1.43	14.4
L90-200	8429	31.6	269	35393	1.78	13.0
L90-204	6952	24.6	283	33805	1.48	13.7
L90-207	7896	30.8	257	37435	1.61	14.5
L90-208	6984	25.0	280	33351	1.51	12.5
L90-216	8581	38.2	223	45602	1.68	13.9
L90-218	10893	38.4	284	39704	1.93	13.1
L90-223	6503	24.9	260	32897	1.50	15.3
$MSD_{.05}$	7864	26.0	29	14302	0.81	1.2

Table 9. 1992 first ratoon means of the 1990 "L" series at the St. Gabriel Research Station on a Commerce silt loam.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk number	Stalk weight	Fiber
	lbs/A	tons/A	lbs/ton	no/A	lbs	%
CP65-357	9126	31.8	287	31536	2.03	13.4
CP70-321	6386	22.0	290	20646	2.18	11.3
CP74-383	12367	43.4	285	49459	1.76	11.8
L90-170	11891	44.3	268	49913	1.78	15.1
L90-171	10545	42.0	248	37208	2.26	13.5
L90-176	8860	32.6	273	47190	1.38	16.4
L90-178	9475	33.4	284	40157	1.69	13.0
L90-181	8404	33.8	249	33351	2.08	12.1
L90-188	9489	34.1	277	36527	1.92	12.8
L90-190	8325	32.6	259	34486	1.87	13.3
L90-191	8975	34.2	262	41065	1.68	13.9
L90-194	11502	40.1	286	32670	2.45	11.8
LCP90-198	8182	31.9	256	27452	2.31	14.1
L90-200	8186	33.0	249	31309	2.11	13.6
L90-204	6519	26.6	246	34939	1.52	14.6
L90-207	12955	45.5	286	45148	2.01	13.1
L90-208	9222	33.4	276	42199	1.61	12.6
L90-216	8297	38.7	218	45829	1.68	14.0
L90-218	12094	42.8	284	40384	2.12	14.3
L90-223	10894	44.9	243	42653	2.13	16.7
$MSD_{.05}$	4848	17.4	29	16888	0.68	1.2

Table 10. 1992 first ratoon means of the 1990 "L" series across locations[1].

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk number	Stalk weight	Fiber
	lbs/A	tons/A	lbs/ton	no/A	lbs	%
CP65-357	8649	30.7	285	32368	1.86	13.1
CP70-321	7335	25.5	289	25108	1.99	11.5
CP74-383	11960	44.5	270	43787	1.99	11.8
L90-170	8960	33.3	272	40535	1.62	14.1
L90-171	8894	34.0	262	34259	1.96	13.3
L90-176	7420	27.3	271	46056	1.17	15.5
L90-178	10660	36.1	295	43651	1.66	13.5
L90-181	7680	31.0	248	34712	1.84	12.4
L90-188	9964	35.6	276	36149	1.97	12.9
L90-190	9316	36.4	257	40913	1.78	12.9
L90-191	8874	32.9	270	39779	1.65	13.8
L90-194	10280	36.6	282	32761	2.21	11.9
LCP90-198	8681	33.4	260	33578	1.97	14.4
L90-200	10086	37.4	267	37132	2.00	13.7
L90-204	8242	31.2	267	39401	1.56	14.3
L90-207	9933	37.4	264	42501	1.74	14.4
L90-208	9950	35.0	283	42350	1.64	12.9
L90-216	9068	41.2	221	44695	1.86	13.9
L90-218	11744	42.1	280	41065	2.05	13.8
L90-223	9282	37.7	248	41382	1.80	16.4
$MSD_{.05}$	4235	13.8	18	9385	0.33	0.9

[1] Iberia Research Station, St. Gabriel Sharkey clay and Commerce silt loam.

Table 11. 1992 plant cane means for the 1990 "L" series at Peebles Plantation.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk number	Stalk weight
	lbs/A	tons/A	lbs/ton	no/A	lbs
CP65-357	7808	25.9	302	20419	2.54
CP70-321	6891	25.3	274	24049	2.11
CP74-383	10376	38.3	271	31309	2.43
L90-170	8515	32.0	267	31082	2.06
L90-171	8133	31.2	261	29267	2.15
L90-176	5778	19.9	291	25637	1.56
L90-178	9692	31.9	304	32216	1.98
L90-181	7405	29.2	254	26771	2.18
L90-188	7487	26.1	287	27225	1.92
L90-190	6485	24.5	266	27679	1.77
L90-191	8022	30.6	262	34258	1.79
L90-194	9043	31.4	289	25864	2.40
LCP90-198	8208	32.9	250	30402	2.16
L90-200	7981	27.1	284	23595	2.23
L90-204	6913	26.1	266	28813	1.81
L90-207	5129	19.8	260	27452	1.44
L90-208	9169	33.8	272	35393	1.91
L90-216	7979	32.9	248	33124	2.01
L90-218	10009	34.5	291	31309	2.20
L90-223	6079	23.5	260	21326	2.29
$MSD_{.05}$	5129	18.3	31	14066	1.90

Table 12. 1992 plant cane means for the 1990 "L" series at Westfield Plantation.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk number	Stalk weight
	lbs/A	tons/A	lbs/ton	no/A	lbs
CP65-357	5456	19.7	276	17697	2.21
CP70-321	5413	21.1	257	20192	2.09
CP74-383	6864	30.7	225	27906	2.20
L90-170	5415	20.6	264	22461	1.83
L90-171	6243	25.6	244	20646	2.48
L90-176	5952	21.1	282	29948	1.44
L90-178	7122	25.4	280	25637	1.98
L90-181	5023	20.7	244	20419	2.03
L90-188	4484	16.6	271	14974	2.22
L90-190	7062	26.5	267	25410	2.08
L90-191	3945	15.4	257	17470	1.77
L90-194	6610	22.8	291	19058	2.40
LCP90-198	6981	27.0	260	20419	2.63
L90-200	6755	25.7	264	21327	2.42
L90-204	5562	22.0	253	21554	2.05
L90-207	6639	24.9	267	22688	2.19
L90-208	5041	20.5	247	22688	1.84
L90-216	6508	29.8	221	27679	2.15
L90-218	7929	29.4	269	27452	2.13
L90-223	4390	16.7	261	17924	1.82
$MSD_{.05}$	2447	8.9	26	8671	0.45

Table 13. 1992 plant cane means of the 1990 "L" series across locations.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk number	Stalk weight
	lbs/A	tons/A	lbs/ton	no/A	lbs
CP65-357	6632	22.8	289	19058	2.37
CP70-321	6152	23.2	265	22120	2.10
CP74-383	8620	34.5	248	29608	2.31
L90-170	6965	26.3	265	26772	1.94
L90-171	7188	28.4	253	24956	2.31
L90-176	5865	20.5	286	27792	1.50
L90-178	8407	28.7	292	28927	1.98
L90-181	5817	23.5	247	22536	2.08
L90-188	5985	21.4	279	21100	2.07
L90-190	6774	25.5	266	26545	1.93
L90-191	5983	23.0	259	25864	1.78
L90-194	7826	27.1	290	22461	2.40
LCP90-198	7594	29.9	255	25410	2.40
L90-200	7368	26.4	274	22461	2.32
L90-204	6237	24.0	259	25183	1.93
L90-207	5884	22.3	263	25070	1.81
L90-208	7105	27.1	259	29041	1.87
L90-216	7243	31.3	234	30402	2.08
L90-218	8969	31.9	280	29381	2.17
L90-223	5234	20.1	260	19625	2.05
$MSD_{.05}$	2865	9.0	21	8838	0.52

[1] Peebles Plantation and Westfield Plantation.

Table 14. 1992 plant cane means for the 1991 "L" series at the Iberia Research Station.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk number	Stalk weight
	lbs/A	tons/A	lbs/ton	no/A	lbs
CP65-357	13167	43.3	304	32217	2.68
CP70-321	7682	26.8	286	20646	2.60
CP74-383	12612	47.0	269	38569	2.44
L91-229	11608	45.6	255	38115	2.39
L91-230	11545	43.0	269	36073	2.38
L91-232	9478	35.4	268	33805	2.10
L91-234	5568	19.4	287	26091	1.49
L91-240	8440	32.4	261	29494	2.20
L91-248	10348	39.2	265	33578	2.36
L91-250	8362	28.4	294	29721	1.98
L91-252	8155	30.1	272	22234	2.70
L91-253	6486	22.7	286	22688	2.00
L91-254	8435	31.2	273	25411	2.48
L91-255	11166	37.3	300	31990	2.33
L91-256	8353	30.2	279	29267	2.05
L91-257	5778	20.7	283	26318	1.57
L91-258	7604	28.6	267	21780	2.62
L91-261	7743	26.1	299	28587	1.80
L91-262	7917	30.3	264	20646	2.90
L91-264	7692	28.0	275	27225	2.06
L91-265	7320	26.9	274	21327	2.52
L91-266	9055	31.5	289	26318	2.40
L91-267	11113	42.1	264	24503	3.43
L91-268	9533	33.9	282	34939	1.94
L91-271	8484	28.9	294	32897	1.76
L91-272	5373	22.1	226	22007	1.93
L91-273	10132	36.7	279	29948	2.44

Table 14. Continued.

L91-274	5329	19.5	273	19739	1.97
L91-275	6966	24.2	288	31082	1.55
L91-276	6335	21.8	291	22461	1.95
L91-281	10517	37.3	282	39703	1.88
L91-282	8322	29.7	282	24957	2.35
L91-283	6314	23.9	267	29721	1.58
L91-284	6892	23.5	294	24956	1.86
L91-285	8530	30.7	279	26091	2.35
L91-286	6339	22.3	285	31990	1.39
L91-287	8569	31.8	272	31082	2.05
L91-288	10735	36.7	293	42426	1.73
L91-290	9141	32.4	276	32217	1.98
$MSD_{.05}$	4628	15.2	38	9794	0.63

Table 15. 1992 plant cane means for the 1991 "L" series at the St. Gabriel Research Station on a Sharkey clay.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk number	Stalk weight
	lbs/A	tons/A	lbs/ton	no/A	lbs
CP65-357	12017	44.5	270	40233	2.21
CP70-321	7911	28.2	281	27225	2.11
CP74-383	9211	35.4	260	30704	2.29
L91-229	9315	45.8	204	39704	2.31
L91-230	10206	42.2	242	36754	2.30
L91-232	10768	43.6	247	40384	2.18
L91-234	7775	30.0	260	38342	1.57
L91-240	8499	34.7	246	31990	2.18
L91-248	9291	39.7	235	37435	2.12
L91-250	9065	32.4	280	36754	1.77
L91-252	9190	36.9	249	27906	2.66

Table 15. Continued.

L91-253	7957	29.8	267	31763	1.88
L91-254	7894	33.6	237	24276	2.75
L91-255	14245	53.6	265	40384	2.65
L91-256	8999	35.0	258	36300	1.93
L91-257	7878	29.7	265	38115	1.56
L91-258	9167	40.0	230	35393	2.26
L91-261	10731	39.1	274	39930	1.95
L91-262	9730	41.8	233	32217	2.65
L91-264	10325	40.6	256	41292	1.97
L91-265	6762	29.0	235	28814	2.02
L91-266	9065	34.1	264	31309	2.16
L91-267	8446	34.9	242	24503	2.85
L91-268	9546	35.7	268	37435	1.90
L91-271	10370	36.7	283	36527	2.01
L91-272	6781	26.9	252	25864	2.10
L91-273	6883	27.9	247	32217	1.73
L91-274	7672	29.5	261	24503	2.40
L91-275	8963	32.6	275	33124	1.99
L91-276	9700	34.9	279	36527	1.90
L91-281	10477	41.8	251	40157	2.09
L91-282	8047	35.9	224	26318	2.74
L91-283	6570	27.6	240	44014	1.25
L91-284	9877	36.6	270	31536	2.32
L91-285	11044	44.2	250	31763	2.79
L91-286	10650	42.8	250	44695	1.92
L91-287	8935	35.7	252	35847	1.99
L91-288	7638	29.4	261	36981	1.62
L91-290	11258	40.0	282	40611	1.97
$MSD_{.05}$	2856	9.7	25	7910	0.45

Table 16. 1992 plant cane means of the 1991 "L" series across locations.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk number	Stalk weight
	lbs/A	tons/A	lbs/ton	no/A	lbs
CP65-357	12477	44.0	284	37026	2.40
CP70-321	7819	27.6	283	24594	2.31
CP74-383	10571	40.0	263	33850	2.35
L91-229	10461	45.7	230	38909	2.35
L91-230	10876	42.6	256	36414	2.34
L91-232	10123	39.5	258	37094	2.14
L91-234	6671	24.7	273	32217	1.53
L91-240	8469	33.5	254	30742	2.19
L91-248	9819	39.4	250	35506	2.24
L91-250	8713	30.4	287	33237	1.87
L91-252	8672	33.5	260	25070	2.68
L91-253	7221	26.3	276	27225	1.94
L91-254	8165	32.4	255	24843	2.62
L91-255	12705	45.4	282	36187	2.49
L91-256	8676	32.6	268	32784	1.99
L91-257	6828	25.2	274	32216	1.56
L91-258	8386	34.3	248	28587	2.44
L91-261	9237	32.6	286	34258	1.87
L91-262	8824	36.0	248	26431	2.78
L91-264	9447	36.4	262	36603	2.00
L91-265	7041	27.9	254	25070	2.27
L91-266	9060	32.8	276	28814	2.28
L91-267	9780	38.5	253	24503	3.14
L91-268	9539	34.8	275	36187	1.92
L91-271	9427	32.8	288	34712	1.88
L91-272	6077	24.5	239	23935	2.02
L91-273	8508	32.3	263	31082	2.08

Table 16. Continued.

L91-274	6500	24.5	267	22121	2.19
L91-275	7965	28.4	282	32103	1.77
L91-276	8018	28.3	285	29494	1.93
L91-281	10497	39.5	267	39930	1.99
L91-282	8184	32.8	253	25637	2.55
L91-283	6442	25.7	253	36867	1.42
L91-284	8385	30.0	282	28246	2.09
L91-285	9787	37.5	264	28927	2.57
L91-286	8494	32.5	267	38342	1.65
L91-287	8752	33.8	262	33464	2.02
L91-288	9186	33.0	277	39703	1.67
L91-290	10200	36.2	279	36414	1.98
$MSD_{.05}$	3318	11.2	22	7886	0.44

[1] Iberia Research Station and St. Gabriel Sharkey clay.

1992 LOUISIANA (L) INFIELD VARIETY TRIALS

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With mild temperatures during the 1991-92 winter and fairly dry conditions in the spring, the 1992 sugarcane crop at St. Gabriel looked promising early in the year. The summer brought typical weather conditions, with rainfall and temperatures near normal, and the sugarcane crop continued to look good into August.

Hurricane Andrew hit the coast of Louisiana below Morgan City at 3:00 am on Wednesday morning, August 26, and rocked the sugarcane belt through midday. Winds at Morgan City were clocked at more than 120 mph. Baton Rouge reported wind gusts of 70 mph and sustained winds of 30-40 mph or more for more than six hours. Initial observations on farms in the sugarcane belt were mixed, with the most extensive damage observed in the Teche Region and less damage in the Mississippi River, Bayou Lafourche, and Northern Regions in the belt.

All sugarcane on the St. Gabriel Station was lodged with some tests and varieties appearing worse than others. Much of the sugarcane on the station attempted to right itself in the following weeks but all stalks contained the familiar bow common on lodged sugarcane. One direction mechanical harvesting was required depending on the direction of the lodging.

The infield variety trials of the Louisiana (L) Sugarcane Variety Development Program are planted from the year after number assignment through the year of introduction to outfield test locations for seed increase. During these trials, experimental varieties will be machine harvested for the first time. The test's purpose is to initiate screening of experimental clones for mechanical harvestability and to obtain estimated yields on a larger plot basis then used by earlier stages in the selection program.

The infield variety trials were planted in a Sharkey clay (very fine, mont-morillontic, nonacid, thermic, typic hydralquent) and a Commerce silt loam (fine-silty, mixed, nonacid, thermic, aeric fluvaquent) soils on the St. Gabriel Research Station and in a Commerce silt loam at the USDA-ARS Ardoyne Farm near Chacahoula, LA. For each assignment series infield tests are planted for three years. In the past, in the first year of the test each agency (LSU and USDA) would plant their own respective experimental varieties on their own farms and would also exchange the same varieties to plant seedcane plots at the other agency's farm. In the following two years the varieties were planted together in tests at each agency's farm. Thus LSU-developed varieties were planted in six infield tests at St. Gabriel and two infield tests at the Ardoyne Farm prior to introduction to the outfield tests. Starting in 1992 the last replanting of the infield tests was discontinued and in exchange the introductory plots of the outfield tests were planted in a standardized fashion to enable comparative yield estimates to be made in future

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years. We also dropped the first-year light soil infield test at St. Gabriel and instead planted an off-station nursery at Stoute Farms. Thus LSU-developed varieties will be planted in three infield tests at St. Gabriel and one infield test at the Ardoyne Farm prior to introduction to the outfield tests.

Planting dates for the infield variety trials commenced on September 8 and terminated on September 30, 1992 (Table 1). Randomized complete block designs with plots sixteen feet long by three rows wide on six foot centers were used in all trials. Included in all trials were three commercial check varieties, CP74-383, CP70-321, and LCP82-089. Note that in 1992 LCP82-089 replaced CP65-357 as a check in all breeding program tests. Unburned plots were mechanically cut and weighed with a tractor mounted hydraulic weigh rig from October 30 through December 4, 1992. No adjustments were made for trash weight. Ten-stalk samples, stripped of leaves, were used to estimate stalk weight and obtain a juice analysis.

Brix was measured by refractometer and sucrose by polarization. Theoretical recoverable sugar (reported as sucrose content) was calculated according to Gravois and Milligan (1992) assuming a 12.5% fiber when fiber was not available. Sucrose yield was estimated as the product of cane yield and sucrose content.

Analysis of variance was performed for each crop and assignment series over and by soil type when appropriate. Minimum significant differences (MSD) were calculated by the Waller-Duncan multiple range test (SAS, 1985).

Normal cultural practices were used in 1992. Sinbar (1/2 lb./A terbacil) + Atrazine (2 qt./A) was applied to tests on Sharkey clay and Sencor 4L (2 qt./A;41% AI) + Atrazine (2 qt./A) was applied to tests on Commerce silt loam after planting in the fall. In early February, 2-4,D (1 qt./A; 46.88% AI) + Atrazine (2 qt./A) was applied to all plant cane and ratoon trials. During the third week of April, Sencor 4L (2 qt.;41% AI) + 2-4,D (1 qt./A; 46.88% AI) was applied after off-barring. Asulox (4.0 pts./A) was applied once in early April and again, where needed, in May. Fields were fertilized with (120 lbs. N; 32% liquid N) in April. Sugarcane borer (*Diatrea saccharalis* F) populations were monitored in June, July, and August. Borer infestations reached economic thresholds during July on the lighter soil and were treated with one ground application of Asana (0.033 lbs./A) on July 17 or 20. A second application of Guthion (0.75 lbs./A) was applied by helicopter on August 2 to all sugarcane tests at St Gabriel. No further applications were made.

References:

Gravois, K.A. and S.B. Milligan. 1992. Genetic relationships between fiber and sugarcane yield components. Crop Sci. 32: 62-66.

SAS Institute Inc. SAS User's Guide: Statistics, Ver. 5 ed. Cary, NC: SAS Institute Inc., 1985 956pp.

Table 1. Planting and harvest dates of infield tests[1]

Assignment Series	Reps	Soil[2] Texture	Planting Dates	Harvest Dates 1992	1991	1990	Varieties[3] No. Planted	No. Harvest	Table No.
1986 L & CP	2	C.s.l.*	9/12/89	10/21	10/31	11/19	20	4	2
1986 L & CP	2	C.s.l.	9/21/89	10/30	10/29	11/20	20	4	3
1986 L & CP	2	S.c.	9/21/89	11/13	10/24	11/20	20	4	4
1987 L	2	C.s.l.*	9/13/89	10/20	11/12	11/26	13	5	6
1987 L & CP	1	C.s.l.	9/19/89	10/30	10/24	11/20	36	5	7
1987 L & CP	1	S.c.	9/19/89	11/13	ns	11/20	36	5	7
1988 L	2	C.s.l.	8/25/89	10/30	10/29	11/21	28	5	9
1988 L	2	S.c.	9/22/89	11/13	10/31	11/20	28	5	10
1987 L & CP	2	C.s.l.*	8/21/90	10/29	11/19		23	5	12
1987 L & CP	2	C.s.l.	8/21/90	11/23	11/18		24	5	13
1987 L & CP	2	S.c.	8/30/90	11/20	11/15		24	5	14
1988 L & CP	2	C.s.l.*	8/31/90	10/28	11/21		42	9	16
1988 L & CP	2	C.s.l.	8/22/90	11/23	11/18		41	9	17
1988 L & CP	2	S.c.	9/26/90	11/20	11/14		41	9	18
1989 L	2	C.s.l.	9/28/90	11/23	11/20		49	9	20
1989 L	2	S.c.	9/25/90	11/20	11/21		49	9	21
1988 L & CP	2	C.s.l.*	10/1/91	11/18			16	9	23
1988 L & CP	2	C.s.l.	9/25/91	12/4			16	9	24
1988 L & CP	2	S.c.	10/1/91	11/30			15	9	25
1989 L & CP	2	C.s.l.*	9/19/91	12/1			56	26	27
1989 L & CP	2	C.s.l.	9/26/91	12/4			53	26	28
1989 L & CP	2	S.c.	10/7/91	11/30			27	9	29
1990 L	2	C.s.l.	10/4/91	12/4			42	20	31
1990 L	2	S.c.	9/27/91	11/30			42	21	32
1990 L & CP	2	C.s.l.*	9/15/92				42		
1990 L & CP	2	C.s.l.	9/8/92				41		
1990 L & CP	2	S.c.	9/9/92				41		
1991	2	S.c.	9/30/92				39		

[1] Tests conducted at the St. Gabriel Res. Stn. and the Ardoyne Farm.
[2] C.s.l. - Commerce silt loam; S.c. - Sharkey clay; C.s.l. * - Ardoyne Farm Commerce silt loam.
[3] Number of varieties per replication including 3 commercial checks. ns - not sampled.

Table 2. 1992 second ratoon means of the 1986 "L" series at Ardoyne Farm.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number
	lbs/A	tons/A	lbs/ton	lbs	no/A
CP65-357	6575	26.9	244	1.85	29090
CP70-321	8420	34.2	246	2.08	32861
CP74-383	8399	35.6	236	1.99	35909
LCP86-454	7500	28.4	264	2.19	25910
$MSD_{.05}$	1682	6.0	7	NS	3375

Table 3. 1992 second ratoon means of the 1986 "L" series at the St. Gabriel Research Station on a Commerce silt loam.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number
	lbs/A	tons/A	lbs/ton	lbs	no/A
CP65-357	8386	28.0	300	1.75	32040
CP70-321	6994	24.1	290	1.90	25389
CP74-383	8310	30.7	271	2.05	29953
LCP86-454	9952	33.4	298	2.45	27348
$MSD_{.05}$	534	2.3	21	0.45	3711

Table 4. 1992 second ratoon means of the 1986 "L" series at the St. Gabriel Research Station on a Sharkey clay.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number
	lbs/A	tons/A	lbs/ton	lbs	no/A
CP65-357	5422	16.9	317	1.95	16900
CP70-321	5032	17.4	290	1.65	21048
CP74-383	5857	22.9	256	1.75	26425
LCP86-454	8748	28.1	312	2.15	26719
$MSD_{.05}$	1950	7.2	45	NS	NS

Table 5. 1992 second ratoon means of the 1986 "L" series across locations[1].

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number
	lbs/A	tons/A	lbs/ton	lbs	no/A
CP65-357	6986	25.6	281	1.85	28042
CP70-321	7045	26.5	271	1.91	27351
CP74-383	7647	30.6	252	1.94	31497
LCP86-454	8557	29.7	287	2.25	26552
$MSD_{.05}$	NS	NS	24	0.33	NS

[1] Ardoyne Farm, St. Gabriel Commerce silt loam and Sharkey clay.

Table 6. 1992 second ratoon means of the 1987 "L" series at Ardoyne Farm.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number	Fiber
	lbs/A	tons/A	lbs/ton	lbs	no/A	%
CP65-357	6912	26.9	257	1.96	27496	14.1
CP70-321	7845	31.1	252	1.95	31933	.
CP74-383	7387	31.6	234	1.73	36610	.
LCP87-017	8591	35.1	244	2.03	34597	12.8
LCP87-491	7960	31.7	247	1.47	43062	12.9
$MSD_{.05}$	NS	5.1	NS	0.33	7679	NS

Table 7. 1992 second ratoon means of the 1987 "L" series across St. Gabriel Commerce silt loam and Sharkey clay.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number
	lbs/A	tons/A	lbs/ton	lbs	no/A
CP65-357	5245	17.2	307	1.65	19741
CP70-321	7457	26.7	280	1.80	30291
CP74-383	7228	25.2	288	1.95	25729
LCP87-017	9954	36.8	271	1.95	37881
LCP87-491	5825	21.6	259	1.35	26111
$MSD_{.05}$	NS	NS	31	NS	NS

Table 8. 1992 second ratoon means of the 1987 "L" series across locations[1].

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number
	lbs/A	tons/A	lbs/ton	lbs	no/A
CP65-357	6079	22.1	282	1.81	23618
CP70-321	7651	28.9	266	1.87	3112
CP74-383	7307	28.4	261	1.84	31170
LCP87-017	9272	35.9	258	1.99	36239
LCP87-491	6893	26.6	253	1.41	34586
$MSD_{.05}$	2771	9.6	NS	0.39	NS

[1] Ardoyne Farm, St. Gabriel Commerce silt loam and Sharkey clay.

Table 9. 1992 second ratoon means of the 1988 "L" series at the St. Gabriel Research Station on a Commerce silt loam.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number
	lbs/A	tons/A	lbs/ton	lbs	no/A
CP65-357	6437	22.1	292	2.10	21048
CP70-321	9409	32.7	288	2.00	32650
CP74-383	8979	31.3	287	2.10	29923
L88-046	8439	29.6	285	1.80	32889
L88-063	8412	30.6	275	1.70	36028
$MSD_{.05}$	2046	6.6	NS	0.22	5384

Table 10. 1992 second ratoon means of the 1988 "L" series at the St. Gabriel Research Station on a Sharkey clay.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number
	lbs/A	tons/A	lbs/ton	lbs	no/A
CP65-357	6901	22.6	306	2.25	19989
CP70-321	5202	18.0	290	1.90	19150
CP74-383	6916	26.4	262	1.85	28394
L88-046	7400	25.3	293	1.45	34877
L88-063	8279	29.8	278	1.75	34092
$MSD_{.05}$	NS	NS	15	0.30	12941

Table 11. 1992 second ratoon means of the 1988 "L" series over soil types at the St. Gabriel Research Station.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number
	lbs/A	tons/A	lbs/ton	lbs	no/A
CP65-357	6669	22.4	299	2.18	20518
CP70-321	7306	25.3	289	1.95	25900
CP74-383	7947	28.8	275	1.98	29158
L88-046	7919	27.5	289	1.63	33883
L88-063	8345	30.2	277	1.73	35060
MSD	NS	NS	NS	0.41	11990

Table 12. 1992 first ratoon means of the 1987 "L" series at Ardoyne Farm.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number	Fiber
	lbs/A	tons/A	lbs/ton	lbs	no/A	%
CP65-357	9015	31.4	288	2.04	30871	11.6
CP70-321	10444	38.9	269	2.07	37543	10.7
CP74-383	8054	31.6	256	1.85	34100	13.4
LCP87-017	9051	36.0	251	1.70	42880	13.6
LCP87-491	9261	36.1	258	1.61	44940	12.4
$MSD_{.05}$	770	5.6	33	0.38	13233	1.8

Table 13. 1992 first ratoon means of the 1987 "L" series at the St. Gabriel Research Station on a Commerce silt loam.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number
	lbs/A	tons/A	lbs/ton	lbs	no/A
CP65-357	7854	26.6	296	2.05	26019
CP70-321	9470	31.6	300	2.20	28655
CP74-383	9801	33.7	292	2.10	32048
LCP87-017	10378	38.2	272	1.85	41167
LCP87-491	9693	35.2	276	1.85	38056
$MSD_{.05}$	NS	NS	18	0.14	12772

Table 14. 1992 first ratoon means of the 1987 "L" series at the St. Gabriel Station on a Sharkey clay.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number
	lbs/A	tons/A	lbs/ton	lbs	no/A
CP65-357	5708	19.4	294	1.90	20422
CP70-321	8917	30.3	295	2.10	29014
CP74-383	6717	26.9	250	2.10	25650
LCP87-017	9447	34.6	273	2.20	31467
LCP87-491	8265	31.9	259	1.85	34794
$MSD_{.05}$	3124	9.2	20	NS	16662

Table 15. 1992 first ratoon means of the 1987 "L" series across locations[1].

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number
	lbs/A	tons/A	lbs/ton	lbs	no/A
CP65-357	7525	25.8	292	2.00	25771
CP70-321	9610	33.6	288	2.12	31737
CP74-383	8190	30.7	266	2.02	30599
LCP87-017	9625	36.3	265	1.92	38504
LCP87-491	9073	34.4	264	1.77	39263
$MSD_{.05}$	1796	5.0	20	0.28	3702

[1] Ardoyne Farm, St. Gabriel Commerce silt loam and Sharkey clay.

Table 16. 1992 first ratoon means of the 1988 "L" & "CP" series at Ardoyne Farm.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number	Fiber
	lbs/A	tons/A	lbs/ton	lbs	no/A	%
CP65-357	8624	31.5	274	1.91	33019	12.5
CP70-321	8886	33.9	261	1.75	39056	.
CP74-383	8655	34.8	249	2.08	33619	.
L88-046	8658	33.0	262	1.84	35859	10.8
L88-063	8907	33.1	269	1.69	39302	11.7
CP88-702	8037	37.4	215	2.09	35750	9.9
CP88-739	9809	34.9	281	2.06	33857	10.8
CP88-764	8632	35.7	243	2.36	30698	10.1
CP88-769	8735	32.4	270	2.08	31145	12.7
$MSD_{.05}$	NS	NS	24	0.39	NS	1.0

Table 17. 1992 first ratoon means of the 1988 "L" & "CP" series at the St. Gabriel Research Station on a Commerce silt loam.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number
	lbs/A	tons/A	lbs/ton	lbs	no/A
CP65-357	6526	22.0	294	2.05	21292
CP70-321	8014	27.8	288	2.05	27060
CP74-383	9001	32.4	278	2.25	28759
L88-046	7102	25.9	273	1.95	26598
L88-063	8230	29.3	281	1.55	37867
CP88-702	6945	25.7	271	2.45	20940
CP88-739	8961	31.6	284	2.00	31617
CP88-764	6526	25.9	250	2.45	21084
CP88-769	7878	26.3	300	2.05	26515
$MSD_{.05}$	NS	11.5	38	0.59	10668

Table 18. 1992 first ratoon means of the 1988 "L" & "CP" series at the St. Gabriel Research Station on a Sharkey clay.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number
	lbs/A	tons/A	lbs/ton	lbs	no/A
CP65-357	6991	24.3	288	2.20	22064
CP70-321	8640	31.1	284	2.20	28273
CP74-383	6836	25.2	271	2.20	22998
L88-046	8046	28.9	278	1.95	29723
L88-063	8592	32.3	265	1.70	38000
CP88-702	8241	30.3	272	2.55	23723
CP88-739	8694	30.4	287	2.05	29726
CP88-764	9514	35.6	267	2.30	31023
CP88-769	7798	27.1	288	2.20	24746
$MSD_{.05}$	2077	6.4	24	0.31	8423

Table 19. 1992 first ratoon means of the 1988 "L" & "CP" series across locations[1].

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number
	lbs/A	tons/A	lbs/ton	lbs	no/A
CP65-357	7380	25.9	285	2.05	25458
CP70-321	8488	30.9	277	2.00	32101
CP74-383	8164	30.8	266	2.18	28458
L88-046	7935	29.3	271	1.91	30726
L88-063	8576	31.6	272	1.65	38390
CP88-702	7741	31.1	253	2.36	26804
CP88-739	9155	32.3	284	2.04	31733
CP88-764	8224	32.4	253	2.37	27601
CP88-769	8137	28.6	286	2.11	27468
$MSD_{.05}$	1730	5.8	19	0.19	5918

[1] Ardoyne Farm, St. Gabriel Commerce silt loam and Sharkey clay.

Table 20. 1992 first ratoon means of the 1989 "L" series at the St. Gabriel Research Station on a Commerce silt loam.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number
	lbs/A	tons/A	lbs/ton	lbs	no/A
CP65-357	8433	27.8	304	2.05	27122
CP70-321	8466	27.9	304	1.90	29339
CP74-383	10565	36.0	294	2.40	30000
LCP89-106	6958	24.2	288	2.10	23259
L89-107	8863	31.2	285	2.10	29714
L89-113	11489	39.5	291	2.40	32955
L89-115	8545	29.7	287	2.20	27000
L89-137	7967	30.1	265	1.80	33389
L89-152	9921	33.9	293	1.85	36670
$MSD_{.05}$	1615	5.1	11	0.20	6665

Table 21. 1992 first ratoon means of the 1989 "L" series at the St. Gabriel Research Station on a Sharkey clay.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number
	lbs/A	tons/A	lbs/ton	lbs	no/A
CP65-357	8015	26.1	308	2.10	24810
CP70-321	9555	32.4	295	2.10	31023
CP74-383	6979	25.8	272	2.35	21933
LCP89-106	6543	22.9	287	2.15	21347
L89-107	8193	31.0	266	2.00	31143
L89-113	8688	30.3	287	2.10	29096
L89-115	8287	28.9	286	2.10	27728
L89-137	8219	29.5	278	1.55	38034
L89-152	10050	34.4	292	1.90	36134
$MSD_{.05}$	3481	10.7	NS	0.33	11384

Table 22. 1992 first ratoon means of the 1989 "L" series over soil types at the St. Gabriel Research Station.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number
	lbs/A	tons/A	lbs/ton	lbs	no/A
CP65-357	8224	26.9	306	2.08	25966
CP70-321	9011	30.1	300	2.00	30181
CP74-383	8772	30.9	283	2.38	25967
LCP89-106	6750	23.6	287	2.13	22303
L89-107	8528	31.1	275	2.05	30428
L89-113	10088	34.9	289	2.25	31026
L89-115	8416	29.3	286	2.15	27364
L89-137	8093	29.8	271	1.68	35711
L89-152	9985	34.1	292	1.88	36402
$MSD_{.05}$	2964	9.1	19	0.27	6286

Table 23. 1992 plant cane means of the 1988 "L" & "CP" series at Ardoyne Farm.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number	Fiber
	lbs/A	tons/A	lbs/ton	lbs	no/A	%
CP65-357	6669	24.5	273	2.15	22723	13.3
CP70-321	5543	19.6	283	2.02	19359	11.3
CP74-383	6181	24.4	253	2.34	20786	12.2
L88-046	6867	25.6	269	1.78	28900	11.7
L88-063	6910	25.1	275	1.82	27576	12.1
CP88-702	7524	28.9	260	2.19	26412	11.7
CP88-739	7653	26.4	290	2.17	24500	11.4
CP88-764	6716	25.0	269	2.28	21900	11.9
CP88-769	6785	24.8	273	2.23	22199	13.7
$MSD_{.05}$	NS	NS	20	0.35	7164	2.1

Table 24. 1992 plant cane means of the 1988 "L" & "CP" series at the St. Gabriel Research Station on a Commerce silt loam.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number
	lbs/A	tons/A	lbs/ton	lbs	no/A
CP65-357	6594	22.9	289	2.70	16926
CP70-321	6909	25.2	274	2.70	18750
CP74-383	7662	28.9	265	2.55	22682
L88-046	8117	30.9	263	2.20	28098
L88-063	8016	30.2	266	2.00	30200
CP88-702	8967	33.3	269	2.30	28887
CP88-739	6075	21.9	278	2.30	19061
CP88-764	7702	28.0	275	2.85	19727
CP88-769	7980	30.6	261	2.60	23500
$MSD_{.05}$	1490	4.6	12	0.39	4364

Table 25. 1992 plant cane means of the 1988 "L" & "CP" series at the St. Gabriel Research Station on a Sharkey clay.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number
	lbs/A	tons/A	lbs/ton	lbs	no/A
CP65-357	7357	25.3	291	2.45	20704
CP70-321	6567	23.2	284	2.20	21083
CP74-383	7257	26.7	272	2.30	23126
L88-046	8756	32.0	274	2.05	31618
L88-063	7614	29.4	260	1.95	30032
CP88-702	7948	29.1	273	2.25	25878
CP88-739	7774	26.3	296	2.30	22864
CP88-764	7939	29.8	266	2.80	21286
CP88-769	7368	26.1	283	2.35	22280
$MSD_{.05}$	1204	5.0	20	0.52	7694

Table 26. 1992 plant cane means of the 1988 "L" & "CP" series across locations[1].

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number
	lbs/A	tons/A	lbs/ton	lbs	no/A
CP65-357	6873	24.2	284	20117	18815
CP70-321	6339	22.7	280	19731	19917
CP74-383	7033	26.6	263	22198	22904
L88-046	7913	29.5	269	29538	29858
L88-063	7513	28.2	267	29269	30116
CP88-702	8146	30.4	268	27059	27382
CP88-739	7167	24.9	288	22134	20962
CP88-764	7355	27.1	271	20908	20247
CP88-769	7378	27.1	272	22660	22890
$MSD_{.05}$	1220	4.2	14	2999	4082

[1] Ardoyne Farm, St. Gabriel Commerce silt loam and Sharkey clay.

Table 27. 1992 plant cane means of the 1989 "L" & CP" series at Ardoyne Farm.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number	Fiber
	lbs/A	tons/A	lbs/ton	lbs	no/A	%
CP65-357	9966	35.0	284	2.34	29928	12.4
CP70-321	8926	31.9	280	2.36	27077	11.2
CP74-383	9507	35.5	268	2.31	30810	11.5
LCP89-106	9052	32.5	279	2.38	27282	13.8
L89-107	8473	30.9	274	2.26	27374	11.6
L89-113	10374	37.5	277	2.26	33490	13.5
L89-115	7926	28.1	283	1.99	28263	12.0
L89-137	8666	31.2	280	1.78	35056	13.0
L89-152	10816	39.0	278	2.05	37999	13.7
CP89-800	9284	32.5	286	2.20	29573	12.2
CP89-805	8407	31.5	267	2.75	23206	10.7
CP89-811	8798	30.6	287	2.63	23257	10.9
CP89-816	11265	42.0	269	2.56	32742	13.2
CP89-825	8077	27.3	296	1.98	27659	10.7
CP89-830	8195	28.8	285	2.43	23676	12.1
CP89-831	9610	34.2	281	2.90	23593	13.3
CP89-843	9578	35.4	270	2.30	30795	10.4
CP89-846	11586	38.4	302	2.23	34692	11.7
CP89-848	9631	32.5	296	2.14	30377	13.0
CP89-855	7472	25.6	292	2.00	25531	11.9
CP89-859	8903	30.6	291	2.49	24566	12.3
CP89-879	10101	36.8	275	2.05	36078	13.6
CP89-884	9095	31.9	287	2.07	30794	12.7
CP89-885	10744	36.6	294	2.42	30245	11.5
CP89-888	11042	37.5	295	2.27	33158	10.2
CP89-889	9003	30.1	300	2.43	24759	12.9
$MSD_{.05}$	2159	7.8	32	0.35	6427	2.2

Table 28. 1992 plant cane means of the 1989 "L" & "CP" series at the St. Gabriel Research Station on a Commerce silt loam.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number
	lbs/A	tons/A	lbs/ton	lbs	no/A
CP65-357	6902	25.2	274	2.90	17380
CP70-321	7114	25.9	275	2.45	21174
CP74-383	8207	33.0	248	2.65	24932
LCP89-106	5939	25.3	235	2.30	22090
L89-107	8238	33.1	249	2.40	27571
L89-113	9256	36.6	253	2.65	27614
L89-115	8693	35.2	247	2.50	28199
L89-137	7868	31.5	250	2.15	29344
L89-152	9720	37.7	258	2.35	32189
CP89-800	8488	33.2	256	2.30	29308
CP89-805	6496	28.2	230	2.70	20889
CP89-811	8571	31.9	269	2.55	25208
CP89-816	8606	35.9	240	2.75	26334
CP89-821	8743	32.6	268	2.50	26080
CP89-825	6048	23.8	255	2.25	21110
CP89-830	6418	23.1	279	2.25	21019
CP89-831	7325	30.6	240	2.90	21177
CP89-843	9603	36.7	262	2.50	29419
CP89-846	10087	36.2	279	2.40	30174
CP89-848	8687	36.4	238	2.90	25104
CP89-855	6787	27.1	250	1.80	30111
CP89-879	8081	32.6	248	2.30	28556
CP89-884	7523	27.7	272	2.40	23084
CP89-885	6950	27.0	257	2.50	21738
CP89-888	9018	33.4	270	2.15	31004
CP89-889	8475	30.1	282	2.65	22644
$MSD_{.05}$	1899	6.2	20	0.65	6964

Table 29. 1992 plant cane means of the 1989 "L" series at the St. Gabriel Research Station on a Sharkey clay.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number
	lbs/A	tons/A	lbs/ton	lbs	no/A
CP65-357	7866	27.1	291	2.55	21183
CP70-321	7210	24.7	293	2.20	22601
CP74-383	8787	31.3	281	2.55	24565
LCP89-106	6464	24.7	262	2.35	21195
L89-107	8835	33.5	264	2.45	27394
L89-113	9764	37.9	258	2.35	32254
L89-115	7759	29.3	265	2.40	24465
L89-137	9510	35.2	270	1.95	36453
L89-152	8905	31.9	280	1.80	35813
$MSD_{.05}$	1435	6.2	23	0.42	10533

Table 30. 1992 plant cane means of the 1989 "L" & "CP" series at the St. Gabriel Research Station and Ardoyne Farm on a Commerce silt loam.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number
	lbs/A	tons/A	lbs/ton	lbs	no/A
CP65-357	8434	30.1	279	2.62	23654
CP70-321	8020	28.9	278	2.40	24125
CP74-383	8857	34.3	258	2.48	27871
LCP89-106	7495	28.9	257	2.34	24686
L89-107	8355	32.0	262	2.33	27472
L89-113	9815	37.0	265	2.45	30552
L89-115	8309	31.6	265	2.25	28231
L89-137	8267	31.3	265	1.97	32200
L89-152	10268	38.3	268	2.20	35094
CP89-800	8886	32.8	271	2.25	29440
CP89-805	7451	29.9	249	2.73	22047
CP89-811	8684	31.2	278	2.59	24233
CP89-816	9936	38.9	254	2.65	29538
CP89-821	8743	32.6	268	2.50	26080
CP89-825	7063	25.5	276	2.11	24385
CP89-830	7306	25.9	282	2.34	22347
CP89-831	8468	32.4	260	2.90	22385
CP89-843	9590	36.0	266	2.40	30107
CP89-846	10836	37.3	290	2.32	32433
CP89-848	9159	34.5	267	2.52	27740
CP89-855	7130	26.3	271	1.90	27821
CP89-859	8903	30.6	291	2.49	24566
CP89-879	9091	34.7	261	2.17	32317
CP89-884	8309	29.8	280	2.23	26939
CP89-885	8847	31.8	275	2.46	25991
CP89-888	10030	35.4	282	2.21	32081
CP89-889	8739	30.1	291	2.54	23702
MSD	1863	7.2	25	0.41	6234

Table 31. 1992 plant cane means of the 1990 "L" series at the St. Gabriel Research Station on a Commerce silt loam.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number
	lbs/A	tons/A	lbs/ton	lbs	no/A
CP65-357	9213	33.3	277	2.30	28894
CP70-321	6868	26.2	262	2.65	19887
CP74-383	8193	33.0	248	2.65	24856
L90-170	7493	28.9	260	1.85	31167
L90-171	8593	35.2	244	2.60	27039
L90-176	8438	30.7	275	1.95	31500
L90-178	7622	26.2	291	2.30	22905
L90-181	6339	26.6	239	2.25	23708
L90-188	7839	29.6	266	2.95	20027
L90-190	6918	27.3	254	2.30	23637
L90-191	7896	30.4	260	2.50	24280
L90-194	6277	26.2	244	2.10	25677
LCP90-198	7949	28.3	283	2.00	28567
L90-200	7309	30.3	242	2.55	23792
L90-204	7328	29.4	249	2.10	27991
L90-207	7704	32.4	238	2.20	29455
L90-208	8340	33.3	250	2.25	29685
L90-216	8835	36.6	241	2.40	30539
L90-218	7736	28.2	274	2.45	23087
L90-223	7549	30.1	251	2.40	25159
$MSD_{.05}$	2141	8.5	29	0.36	11292

Table 32. 1992 plant cane means of the 1990 "L" series at the St. Gabriel Research Station on a Sharkey clay.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number
	lbs/A	tons/A	lbs/ton	lbs	no/A
CP65-357	7862	27.2	289	2.40	22804
CP70-321	8299	28.5	291	2.30	24779
CP74-383	8674	31.5	276	2.65	23727
L90-170	7339	27.0	272	2.05	26312
L90-171	9024	34.2	264	2.35	29055
L90-176	8954	30.9	290	1.85	33354
L90-178	8475	28.3	300	2.15	26327
L90-181	7179	29.7	242	2.65	22507
L90-188	7561	27.5	276	2.65	20713
L90-190	7809	29.2	268	2.25	25945
L90-191	7920	30.2	263	2.23	27359
L90-194	6142	21.4	287	2.25	19080
LCP90-198	8480	32.8	259	2.20	30000
L90-200	7779	29.0	268	2.60	22391
L90-204	6769	26.3	258	2.20	23864
L90-207	7621	28.8	265	2.20	26442
L90-208	8534	32.5	264	2.10	30905
L90-216	7649	34.9	219	2.50	27856
L90-218	7667	27.7	277	2.00	27813
L90-223	6743	26.0	259	2.15	24193
$MSD_{.05}$	2270	6.9	20	0.55	6774

Table 33. 1992 plant cane means of the 1990 "L" series over soil types at the St. Gabriel Research Station.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number
	lbs/A	tons/A	lbs/ton	lbs	no/A
CP65-357	8537	30.2	283	2.35	25849
CP70-321	7584	27.3	276	2.48	22333
CP74-383	8433	32.2	262	2.65	24291
L90-170	7416	28.0	266	1.95	28739
L90-171	8808	34.7	254	2.48	28047
L90-176	8696	30.8	282	1.90	32427
L90-178	8048	27.2	295	2.23	24616
L90-181	6759	28.1	240	2.45	23108
L90-188	7700	28.5	271	2.80	20370
L90-190	7363	28.2	261	2.28	24791
L90-191	7911	30.2	262	2.34	26128
L90-194	6209	23.8	265	2.18	22379
LCP90-198	8215	30.5	271	2.10	29283
L90-200	7544	29.6	255	2.58	23092
L90-204	7049	27.8	253	2.15	25927
L90-207	7662	30.6	252	2.20	27948
L90-208	8437	32.9	257	2.18	30295
L90-216	8242	35.7	230	2.45	29198
L90-218	7702	27.9	275	2.23	25450
L90-223	7146	28.1	255	2.28	24676
$MSD_{.05}$	1161	4.3	26	0.35	5859

1.

1992 OUTFIELD VARIETY TRIALS[1]

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The purpose of the outfield variety trials is to test and identify experimental varieties for potential commercial production. These trials are cooperatively conducted at 13 commercial locations throughout the Louisiana sugarcane belt by the Louisiana Agricultural Experiment Station, the United States Department of Agriculture - Agricultural Research Service and the American Sugar Cane League.

The criteria for a successful variety requires good performance with regard to yield and harvestability across locations, crops, and years relative to commercial varietal responses. Accurate varietal evaluation requires overall performance information in addition to close scrutiny of performance under adverse harvest conditions. The objective of this report is to provide an overall and specific location and crop yield and harvest data for 1992 outfield locations.

A randomized complete block design with three replications was used at each location. Plots were three rows wide (6 foot centers) and 32 feet long with 4 foot gaps between plot ends. The number of millable stalks in all plots were counted in August. All trials were harvested mechanically, separated by hand and then weighed with a tractor-mounted hydraulic weigh rig. A fifteen stalk sample was taken from each plot and sent to the USDA sucrose lab at the Ardoyne Farm for juice analysis.

Two estimates of cane yield were made for each plot. One was based upon stalk counts (stalk counts x stalk weight), the other estimated by plot weight. Plots are unburned prior to weighing so plots weights are reduced by 14% to adjust for leaf-trash weight. All calculations for stalk number per area and cane yield assumed 36 foot long plots. These two adjustments for plot length and trash weight adjusted downward cane yields, sucrose yields and stalk number estimates by 26%.

Interpreting one year yield data can be misleading since performance in one year may not

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[1]The data for this report was obtained through a cooperative effort of personnel from the Louisiana Agricultural Experiment Station - LSUAC, USDA - Agricultural Research Service, Sugarcane Research Unit, and the American Sugar Cane League in accordance to the provisions of the "Three-way Agreement of 1978". The testing program would not be possible without the full cooperation from the growers at each outfield location.

predict future average performance. Across location means can likewise be misleading since a variety, experimental or commercial, may not consistently perform at all locations and this inconsistency may not be clearly indicated in the overall mean. Multiyear and location testing attempts to solve these problems. A primary goal of the yield trials is to identify varieties that reliably produce high yields for Louisiana's sugarcane growing region.

A simple statistic has been included to aid in interpreting a variety's performance relative to other varieties in the test. This statistic is the percentage of the test locations a variety was not significantly (NS) different from the best yielding variety at a specific location. Although the best yielding variety at a location may vary, the "percent best" statistic indicates the percent of the tests a variety was in the best yield group. A variety with a 80% NS from best value was in the highest yielding group in 80% of the tests. This statistic intrinsically places more value on more precise tests and helps the reader avoid making incorrect interpretations of the results due to minor differences in mean values. The statistic also provides a better understanding of varietal yield stability across locations than does the overall mean. The standard deviations presented in percent form in tables 22 through 24 were approximated using the formula:

$$STD = 100[p(1-p)/n]^{1/2}$$

where **p** was the NS from best proportion and **n** was then number of tests (Steel and Torie, 1980).

Analysis of variance was performed for each crop and location combination. A combined analysis was performed over locations within each crop. Minimum significant differences (MSD) were calculated by the Waller-Duncan multiple range test (SAS, 1985).

Twenty-four experimental varieties were introduced to the outfield locations for seed increase in 1992 (Table 1). Outfield personnel planted 11 experimental and six commercial varieties in the outfield tests. Thirteen commercial outfield locations were used in 1992 (Table 2). Researchers planted 11 tests and harvested 12 plant cane, 10 first ratoon and five second ratoon tests. Tests have traditionally been classified by location as a "heavy" or "light' soil textured test. Although this is fundamentally correct, soil texture ranges throughout the sugar belt and often within a test site itself. We've included a textural analysis to better quantify the textural ranges among and within the outfield test sites (Table 3).

1992 varietal yields are reported by crops with overall means and individual location data in the same table (Tables 4-19). Combined analysis among the last three plant cane years (1990-1992) (Table 22), the last two first ratoon years (Table 23), and the last two plant cane years (Table 24) are included to aid evaluation of the most advanced experimental varieties (LCP85-384, CP85-845 and LCP86-454).

The harvestability of a sugarcane variety in Louisiana is affected by the erectness and the brittleness of the variety in interaction with the conditions under which it was grown and harvested (weather, row profile, type and condition of the harvester, and skill of the harvester operator). The harvestability of experimental varieties can be observed under a wide range of conditions in the outfield stage of the variety testing program and is an important function of the tests.

The routine procedure is to document the condition of the test field at the time of harvest. As the test field is cut, the outfield agronomists note the erectness of each variety for which yield data will be taken. The heap row is then subjectively rated for scrappiness or the amount of cane left in the plot. Due the universal lodging caused by Hurricane Andrew, no preharvest lodging notes were made in 1992. We report the number of replications and the percentage of all replications observed in Tables 26 through 29 for the three crops harvested in 1992.

In the past to provide sufficient seed cane to plant the outfield tests, experimental varieties have been planted next to outfield tests in the year prior to planting the regular test. This was continued in 1992 except the introductory plots were planted in a standard plot length to enable the collection of yield data the following year.

References:

Steel, R.G.D, Torrie, J.H. 1980. Principles and procedures of statistics a biometrical approach. McGraw-Hill, New York.

SAS Institute Inc. 1985. SAS user's guide:basics, version 5 ed. SAS Institute, Cary H.C.

Table 1. Varieties planted in the outfield variety trials in 1992.

Commercial Varieties	Experimental Varieties	Varieties introduced to the Outfield	
CP65-357	LCP85-384	LCP89-106	CP89-830
CP70-321	CP85-845	L89-107	CP89-831
CP72-370	LCP86-454	L89-113	CP89-843
CP74-383	LCP87-017	L89-115	CP89-846
LCP82-089	LCP87-491	L89-137	CP89-848
LHo83-153	L88-046	L89-152	CP89-855
	L88-063	CP89-800	CP89-859
	CP88-729	CP89-805	CP89-879
	CP88-739	CP89-811	CP89-884
	CP88-764	CP89-816	CP89-885
	CP88-769	CP89-821	CP89-888
		CP89-825	CP89-889

Table 2. Soil textural class analysis of outfield locations to be harvested in 1993.

Location	Crop	Sand	Silt	Clay	Textural Class
		---------- % ----------			
Ronald Hebert	Plant cane	57	39	4	sandy loam
	1st ratoon	50	42	8	loam
	2nd ratoon	55	40	5	sandy loam
Allain	Plant cane	36	32	32	clay loam
	1st ratoon	31	33	36	clay loam
	2nd ratoon	35	39	26	loam
Oaklawn	Plant cane	38	37	25	loam/sandy loam
	1st ratoon	27	41	32	clay loam
	2nd ratoon	49	44	7	loam/sandy loam
Bon Secour	Plant cane	68	25	7	sandy loam
	1st ratoon	63	30	7	sandy loam
	2nd ratoon	68	30	2	sandy loam
Lanaux	Plant cane	72	27	2	sandy loam
	1st ratoon	70	26	4	sandy loam
	2nd ratoon	68	30	2	sandy loam
Cinclare	Plant cane	67	30	3	sandy loam
	1st ratoon	75	20	5	sandy loam/loamy sand
	2nd ratoon	64	32	4	sandy loam
Palo Alto	Plant cane	44	43	13	loam
St. John	Plant cane	56	36	8	sandy loam
	1st ratoon	43	41	16	loam
Pearce	1st ratoon	73	23	4	sandy loam
	2nd ratoon	64	32	13	loam
Evan Hall	1st ratoon	15	56	29	silty clay loam
	2nd ratoon	39	43	18	loam
Glenwood	Plant cane	67	31	2	sandy loam
	1st ratoon	66	30	4	sandy loam
Georgia	Plant cane	63	35	2	sandy loam
	1st ratoon	67	30	3	sandy loam
	2nd ratoon	56	37	7	sandy loam
Magnolia	Plant cane	60	28	12	sandy loam
	1st ratoon	34	50	16	loam/silt loam
	2nd ratoon	28	54	18	silt loam

Table 3. Plant cane, first ratoon, and second ratoon harvest and planting dates for all outfield locations harvested in 1992.

	Plant cane				First ratoon			Second ratoon		
Location	1992 Plant Date	1992 Harvest Date	1991 Plant Date	Harvesting Comments[1]	1992 Harvest Date	1990 Plant Date	Harvesting Comments	1992 Harvest Date	1989 Plant Date	Harvesting Comments
Allain	10/7	11/16	9/5	wet	11/16	9/05	WIM[2], some wide rows		9/28	
Bon Secour	10/8	11/19	10/2	some tie vine	11/5	10/02	WIM	11/5	8/31	WIM, cane lodged with row
Cinclare	9/18	11/13	10/11	WIM	11/30	10/11	WIM			
Evan Hall		12/2	8/27	wet	12/2	8/27	wet	12/2	10/10	wet
F. Pearce		12/1	10/9		12/1	10/09			9/25	
Georgia	10/15	12/4	10/11		11/17	10/11	wet	11/2	9/14	some stools uprooted
Glenwood	10/12	11/23	9/26							
Lanaux	10/13	12/3	10/25		11/6	10/25				
Magnolia	10/20	11/29	10/1	wet	11/29	10/1	wet, grassy		9/19	
McLeod		12/7	9/26	WIM		9/26			9/20	
Oaklawn	10/2	12/17	9/6	WIM	11/10	9/06		11/10	9/27	WIM
Palo Alto	10/1									
R.Hebert	10/13	12/15	10/4	wet, soft ground	11/9	10/04	wet	11/9	9/25	

1 All tests unless otherwise indicated were harvested with two row harveters in two directions.
2 WIM - water in the rows.

Table 4. Plant cane sucrose yield for seven commercial and five experimental varieties at twelve outfield locations in 1992.

Variety	Heavy textured soil locations					Light textured soil locations								NS from Best[2] (%)
	All.[1]	E.H.	Mag.	McL.	Oak.	B.S.	Cin.	F.P.	Geo.	Gln.	Lan.	R.H.	Mean	
	lbs/A													
CP65-357	5265	6129	5487	6853	9404	6150	8693	4977	7234	4752	7365	6857	6597	67
CP70-321	5276	5230	5324	6535	8000	4837	7517	4922	6744	5354	6157	6826	6083	50
CP72-370	5522	5942	4900	6807	8978	6889	8299	5765	5953	5500	6055	7178	6498	67
CP74-383	4771	5568	3066	6866	8289	5690	8165	5716	6597	5868	6572	6630	6129	42
CP79-318	5542	6629	5843	6394	7869	6138	8167	5235	6951	6369	8087	6743	6689	83
LCP82-089	5384	5883	6094	6135	6662	6425	7868	5899	6427	5372	6957	6412	6304	67
LHo83-153	6497	6728	5382	6001	8264	3416	7909	6829	6394	5920	6833	7628	6483	67
LCP85-384	6257	6684	6054	6210	8442	7181	8724	8265	6530	7504	9083	7964	7408	100
CP85-845	6345	6407	5530	7568	8352	6008	8566	6999	6027	5871	7631	6884	6849	83
LCP86-454	5047	6777	4016	5446	7721	5917	7874	6656	6500	6162	8372	7102	6466	67
LCP87-017	5331	5779	6191	6060	7434	5179	7767	5601	5656	4808	6875	6754	6120	58
LCP87-491	5111	6423	5553	6843	8148	6887	8911	6054	5605	5421	7553	7037	6629	67
MEAN	5536	6176	5271	6465	8130	5893	8205	6082	6385	5742	7295	7001	6523	58
$MSD_{.05}$	1151	1198	919	2265	2304	1286	1910	1397	2175	1301	964	1704	544	

[1] All.-A.V. Allain & Sons, E.H.-Evan Hall, Mag.-Magnolia, McL.-McLeod, Oak.-Oaklawn, B.S.-Bon Secour, Cin.-Cinclare, F.P.-Frank Pearce & Sons, Geo.-Georgia, Gln.-Glenwood, Lan.-Lanaux, R.H.-Ronald Hebert.

[2] Percentage of locations where the variety was not significantly less than the highest yielding variety at that location as determined with the minimum significant difference ($P < 0.05$).

Table 5. Plant cane yield of cane (tons/A) for seven commercial and five experimental varieties at twelve outfield locations in 1992.

Variety	Heavy textured soil locations					Light textured soil locations							Mean	NS from Best[2] %
	All.[1]	E.H.	Mag.	McL.	Oak.	B.S.	Cin.	F.P.	Geo.	Gln.	Lan.	R.H.		
	tons/A													
CP65-357	18.6	22.6	17.7	23.6	32.0	22.2	30.5	17.2	23.8	17.7	25.9	24.9	23.1	50
CP70-321	18.9	19.5	18.3	24.0	28.1	18.0	26.5	18.3	22.2	21.3	22.3	25.6	22.0	33
CP72-370	20.1	22.5	17.1	24.0	31.7	25.5	29.5	22.3	20.4	19.9	23.4	27.0	23.6	58
CP74-383	18.3	21.5	11.4	25.6	30.4	22.9	32.0	23.3	24.3	22.6	26.5	25.7	23.6	67
CP79-318	19.7	23.3	20.1	22.8	27.1	23.3	28.3	19.4	23.6	23.0	29.3	24.9	23.9	75
LCP82-089	20.7	23.3	20.9	21.3	22.9	23.7	28.7	21.3	21.1	20.3	24.9	23.4	22.8	58
LHo83-153	25.2	25.1	19.1	22.3	30.4	14.3	29.3	26.3	23.5	22.6	25.7	28.8	24.4	75
LCP85-384	23.3	24.3	19.7	21.9	28.3	26.6	28.8	28.5	22.7	26.1	32.8	27.0	25.8	100
CP85-845	23.9	24.4	19.3	26.7	30.2	23.2	33.2	26.6	22.3	22.6	28.4	27.0	25.7	92
LCP86-454	18.3	26.2	13.8	19.9	26.5	22.2	28.5	25.3	21.5	24.8	31.4	25.8	23.7	75
LCP87-017	22.3	23.6	22.3	22.3	28.4	20.5	29.4	23.2	20.0	21.0	28.2	26.7	24.0	75
LCP87-491	20.1	25.3	20.6	26.1	28.3	28.0	33.0	22.9	19.7	22.4	28.1	26.9	25.1	75
MEAN	20.8	23.5	18.3	23.3	28.7	22.5	29.8	22.9	22.1	22.0	27.2	26.1	24.0	58
$MSD_{.05}$	2.9	5.2	3.1	7.5	6.7	4.9	5.1	5.3	NS	4.4	3.3	23.0	2.2	

[1] All.-A.V. Allain & Sons, E.H.-Evan Hall, Mag.-Magnolia, McL.-McLeod, Oak.-Oaklawn, B.S.-Bon Secour, Cin.-Cinclare, F.P.-Frank Pearce & Sons, Geo.-Georgia, Gln.-Glenwood, Lan.-Lanaux,R.H.-Ronald Hebert.

[2] Percentage of locations where the variety was not significantly less than the highest yielding variety at that location as determined with the minimum significant difference ($P<0.05$).

Table 6. Plant cane sucrose content for seven commercial and five experimental varieties at twelve outfield locations in 1992.

Variety	Heavy textured soil locations					Light textured soil locations							Mean	NS from Best[2]
	All.[1]	E.H.	Mag.	McL.	Oak.	B.S.	Cin.	F.P.	Geo.	Gln.	Lan.	R.H.		
	lbs/ton cane													
CP65-357	284	272	308	290	294	276	284	291	304	269	284	275	286	83
CP70-321	280	268	291	273	285	268	283	269	303	252	277	266	276	58
CP72-370	275	264	287	284	283	270	282	260	293	277	259	267	275	42
CP74-383	260	259	269	268	273	249	255	246	272	260	248	256	259	8
CP79-318	282	284	291	282	290	265	289	269	295	276	276	272	281	75
LCP82-089	260	252	292	289	291	271	274	278	304	264	279	274	277	50
LHo83-153	258	268	282	270	272	238	270	259	273	262	266	265	265	17
LCP85-384	270	275	308	284	299	271	303	290	286	287	277	295	287	100
CP85-845	264	263	286	283	276	259	258	263	270	258	268	255	267	17
LCP86-454	276	260	291	272	291	266	276	263	303	248	266	277	274	50
LCP87-017	240	246	278	272	261	252	264	242	282	229	243	253	255	8
LCP87-491	255	254	269	262	287	246	270	264	283	243	269	262	264	17
MEAN	266	263	288	278	284	261	276	266	289	260	268	268	272	25
$MSD_{.05}$	17	17	13	23	14	12	19	15	20	17	17	18	6	

[1] All.-A.V. Allain & Sons, E.H.-Evan Hall, Mag.-Magnolia, McL.-McLeod, Oak.-Oaklawn, B.S.-Bon Secour, Cin.-Cinclare, F.P.-Frank Pearce & Sons, Geo.-Georgia, Gln.-Glenwood, Lan.-Lanaux,R.H.-Ronald Hebert.

[2] Percentage of locations where the variety was not significantly less than the highest yielding variety at that location as determined with the minimum significant difference ($P<0.05$).

Table 7. Plant cane stalk number based on plot weights for seven commercial and five experimental varieties at twelve outfield locations in 1992.

Variety	Heavy textured soil locations					Light textured soil locations							Mean	NS from Best[2] %
	All.[1]	E.H.	Mag.	McL.	Oak.	B.S.	Cin.	F.P.	Geo.	Gln.	Lan.	R.H.		
	stalks/A													
CP65-357	15998	18829	16851	15146	25718	19629	22537	14763	22213	14189	20490	19863	18852	17
CP70-321	16166	16458	15949	16605	24756	16355	18371	15633	18056	19703	16914	20526	18009	8
CP72-370	16253	19228	15523	15129	26248	18944	22479	20245	17405	16945	17703	22939	19083	8
CP74-383	19263	19404	10117	18246	23820	20233	23922	20268	21714	20551	21344	20918	20033	17
CP79-318	16241	18841	15521	14571	20498	18813	20192	16312	19165	19146	20406	19246	18309	8
LCP82-089	14609	20818	20756	15845	20932	19254	21170	19670	18566	18158	18910	18720	18930	8
LHo83-153	22530	24129	21217	17472	27850	13747	24140	26805	22367	22170	21583	25585	22466	58
LCP85-384	25100	23088	23527	16416	27434	23352	24166	25417	20488	23958	26426	27910	23940	75
CP85-845	20499	21897	18864	20932	27011	18711	25572	21573	21010	20133	23089	19985	21606	58
LCP86-454	14017	19715	11815	11917	17516	14451	16956	17777	14394	17939	20240	16116	16071	0
LCP87-017	18211	20025	22086	16091	23357	16093	23152	20109	17702	19334	21008	22683	19988	17
LCP87-491	20021	26379	28845	23421	31132	26647	29737	25674	24271	23272	26165	28073	26136	92
MEAN	18301	20834	18505	16775	24689	18852	22700	20373	19779	19625	21190	21880	20307	17
$MSD_{.05}$	3702	6563	4222	3755	6049	4806	4908	5215	4201	4991	4258	3914	1587	

[1] All.-A.V. Allain & Sons, E.H.-Evan Hall, Mag.-Magnolia, McL.-McLeod, Oak.-Oaklawn, B.S.-Bon Secour, Cin.-Cinclare, F.P.-Frank Pearce & Sons, Geo.-Georgia, Gln.-Glenwood, Lan.-Lanaux,R.H.-Ronald Hebert.

[2] Percentage of locations where the variety was not significantly less than the highest yielding variety at that location as determined with the minimum significant difference ($P<0.05$).

Table 8. Plant cane stalk number based on stalk counts for seven commercial and five experimental varieties at twelve outfield locations in 1992.

Variety	Heavy textured soil locations					Light textured soil locations							Mean	NS from Best[2] %
	All.[1]	E.H.	Mag.	McL.	Oak.	B.S.	Cin.	F.P.	Geo.	Gln.	Lan.	R.H.		
	stalks/A													
CP65-357	19232	-----	13855	17151	23895	15108	23298	18345	21872	14453	20658	20446	18938	27
CP70-321	16910	-----	12160	14087	21699	12333	19309	15378	17787	19482	18153	20407	17069	9
CP72-370	18808	-----	14973	14433	17112	16746	20793	18519	16669	17401	18133	22701	17844	9
CP74-383	20311	-----	10136	15320	20195	16361	25553	23683	21910	17247	23086	18191	19396	27
CP79-318	19232	-----	15523	13104	22315	17257	22623	18384	16823	17324	22084	19945	18704	9
LCP82-089	21217	-----	16380	15493	19309	16438	23394	21911	19000	20870	22855	23269	19846	18
LHo83-153	22836	-----	16399	13932	26400	11485	24531	24955	20253	20754	21718	23529	20430	27
LCP85-384	26304	-----	19482	16110	32529	23703	26439	26979	19849	27094	29445	-----	24793	80
CP85-845	20292	-----	15859	18191	23606	17026	22007	24319	16804	18866	22007	-----	19997	30
LCP86-454	16977	-----	10367	10907	18769	14684	19656	20292	14703	18326	21140	-----	16582	10
LCP87-017	21795	-----	16284	17632	23278	14703	22469	20272	15725	16765	21660	-----	19160	20
LCP87-491	22758	-----	22912	22296	26574	23645	27576	25957	20022	23837	26266	-----	24184	60
MEAN	20660	-----	15356	15618	22974	16594	23137	21573	18451	19368	22267	20894	19711	9
$MSD_{.05}$	1615	-----	3158	6039	4664	5572	4389	4922	8166	2758	2032	-----	1680	

[1] All.-A.V. Allain & Sons, E.H.-Evan Hall, Mag.-Magnolia, McL.-McLeod, Oak.-Oaklawn, B.S.-Bon Secour, Cin.-Cinclare, F.P.-Frank Pearce & Sons, Geo.-Georgia, Gln.-Glenwood, Lan.-Lanaux,R.H.-Ronald Hebert.

[2] Percentage of locations where the variety was not significantly less than the highest yielding variety at that location as determined with the minimum significant difference ($P < 0.05$).

Table 9. Plant cane stalk weights for seven commercial and five experimental varieties at twelve outfield locations in 1992.

Variety	Heavy textured soil locations					Light textured soil locations							Mean	NS from Best[2] %
	All.[1]	E.H.	Mag.	McL.	Oak.	B.S.	Cin.	F.P.	Geo.	Gln.	Lan.	R.H.		
	lbs.													
CP65-357	2.35	2.40	2.14	3.11	2.49	2.27	2.76	2.33	2.17	2.51	2.53	2.51	2.46	25
CP70-321	2.33	2.38	2.30	2.89	2.27	2.23	2.89	2.34	2.46	2.17	2.63	2.50	2.45	25
CP72-370	2.48	2.34	2.21	3.18	2.42	2.69	2.64	2.23	2.34	2.36	2.64	2.34	2.49	17
CP74-383	1.90	2.21	2.24	2.81	2.58	2.27	2.71	2.30	2.24	2.21	2.49	2.48	2.36	8
CP79-318	2.43	2.49	2.59	3.11	2.63	2.57	2.81	2.36	2.46	2.41	2.88	2.59	2.62	42
LCP82-089	2.84	2.26	2.03	2.69	2.21	2.47	2.71	2.16	2.27	2.25	2.66	2.50	2.43	8
LHo83-153	2.24	2.08	1.84	2.60	2.18	2.09	2.42	1.96	2.10	2.07	2.38	2.25	2.18	0
LCP85-384	1.86	2.11	1.72	2.68	2.05	2.27	2.39	2.26	2.22	2.18	2.48	1.93	2.18	0
CP85-845	2.34	2.26	2.07	2.54	2.28	2.49	2.60	2.50	2.14	2.25	2.47	2.71	2.39	0
LCP86-454	2.62	2.67	2.35	3.34	3.03	3.07	3.36	2.86	3.01	2.78	3.12	3.20	2.95	100
LCP87-017	2.47	2.37	2.09	2.82	2.44	2.55	2.54	2.31	2.26	2.18	2.70	2.36	2.42	8
LCP87-491	2.02	1.93	1.43	2.24	1.85	2.11	2.23	1.79	1.62	1.92	2.18	1.92	1.94	0
MEAN	2.32	2.28	2.07	2.83	2.37	2.42	2.67	2.29	2.27	2.28	2.60	2.44	2.41	0
$MSD_{.05}$	0.31	0.34	0.37	0.50	0.38	0.30	0.35	0.31	0.27	0.40	0.32	0.24	0.10	

[1] All.-A.V. Allain & Sons, E.H.-Evan Hall, Mag.-Magnolia, McL.-McLeod, Oak.-Oaklawn, B.S.-Bon Secour, Cin.-Cinclare, F.P.-Frank Pearce & Sons, Geo.-Georgia, Gln.-Glenwood, Lan.-Lanaux,R.H.-Ronald Hebert.

[2] Percentage of locations where the variety was not significantly less than the highest yielding variety at that location as determined with the minimum significant difference ($P < 0.05$).

Table 10. First ratoon sucrose yield for seven commercial and three experimental varieties at ten outfield locations in 1992.

Variety	Heavy textured soil locations				Light textured soil locations							NS from Best[2]
	All.[1]	E.H.	Mag.	Oak.	B.S.	Cin.	F.P.	Geo.	Lan.	R.H.	Mean	%
	lbs/A											
CP65-357	4976	4325	5995	5803	6740	8802	----	7657	5271	4891	6051	33
CP70-321	5354	5856	4843	5157	6056	8747	8507	7247	5017	6596	6384	40
CP72-370	4733	5389	5524	5703	7057	9748	8708	7074	3767	6480	6510	50
CP74-383	5102	4917	4948	5112	7765	8603	7549	6743	5350	8324	6479	30
CP79-318	5421	4842	4441	6508	7211	8074	----	7944	5961	7690	6455	44
LCP82-089	5225	6096	6580	6023	5791	8445	5898	7404	5682	4551	6186	40
LHo83-153	6059	3803	5079	5986	6609	8280	----	7522	5824	6679	6204	44
LCP85-384	7035	6172	4082	6879	9139	10711	9798	8321	6478	8345	7696	90
CP85-845	4796	5725	5413	6016	7642	8818	----	7846	6243	6958	6606	56
LCP86-454	5389	5760	5966	6844	6405	8896	9018	8271	6054	6201	6838	60
MEAN	5409	5289	5287	6003	7041	8913	8246	7603	5643	6672	6550	60
$MSD_{.05}$	1344	950	1364	730	1113	1126	1607	NS	2264	1732	755	

[1] All.-A.V. Allain & Sons, E.H.-Evan Hall, Mag.-Magnolia, Oak.-Oaklawn, B.S.-Bon Secour, Cin.-Cinclare, F.P.-Frank Pearce & Sons, Geo.-Georgia, Lan.-Lanaux, R.H.-Ronald Hebert.

[2] Percentage of locations where the variety was not significantly less than the highest yielding variety at that location as determined with the minimum significant difference ($P < 0.05$).

Table 11. First ratoon yield of cane for seven commercial and three experimental varieties at ten outfield locations in 1992.

Variety	Heavy textured soil locations				Light textured soil locations						Mean	NS from Best[2] %
	All.[1]	E.H.	Mag.	Oak.	B.S.	Cin.	F.P.	Geo.	Lan.	R.H.		
	tons/A											
CP65-357	17.3	15.0	18.6	20.5	24.7	30.9	----	26.4	18.8	18.3	21.2	44
CP70-321	19.8	19.6	15.8	18.8	21.6	29.2	29.2	26.4	17.2	24.8	22.4	50
CP72-370	16.8	19.2	18.1	20.0	25.1	32.9	31.5	25.1	13.9	25.3	23.1	50
CP74-383	18.8	17.4	16.4	20.1	30.7	31.7	30.8	25.2	20.5	31.9	24.5	70
CP79-318	18.4	15.8	13.9	22.4	27.5	27.7	----	28.5	22.2	28.3	22.7	40
LCP82-089	18.9	20.3	20.4	21.5	21.9	29.3	20.8	25.8	20.7	17.6	21.8	40
LHo83-153	22.5	13.4	16.7	22.0	26.0	29.1	----	27.5	22.0	25.7	22.8	56
LCP85-384	25.6	20.6	13.2	24.2	32.4	36.0	33.3	28.7	23.2	29.4	26.6	90
CP85-845	17.5	20.8	18.1	20.6	27.9	30.7	----	29.0	23.5	26.7	23.9	67
LCP86-454	19.0	19.7	19.2	22.7	23.2	30.4	31.9	28.8	21.9	24.0	23.9	70
MEAN	19.5	18.2	17.0	21.3	26.1	30.8	29.6	27.1	20.7	25.2	23.3	60
$MSD_{.05}$	4.0	2.8	4.6	2.6	3.9	3.4	5.5	NS	7.0	5.7	2.6	

[1] All.-A.V. Allain & Sons, E.H.-Evan Hall, Mag.-Magnolia, Oak.-Oaklawn, B.S.-Bon Secour, Cin.-Cinclare, F.P.-Frank Pearce & Sons, Geo.-Georgia, Lan.-Lanaux, R.H.-Ronald Hebert.

[2] Percentage of locations where the variety was not significantly less than the highest yielding variety at that location as determined with the minimum significant difference ($P<0.05$).

Table 12. First ratoon sucrose content for seven commercial and three experimental varieties at ten outfield locations in 1992.

Variety	Heavy textured soil locations				Light textured soil locations						Mean	NS from Best[2] %
	All.[1]	E.H.	Mag.	Oak.	B.S.	Cin.	F.P.	Geo.	Lan.	R.H.		
	lbs/ton cane											
CP65-357	286	288	322	283	273	285	---	290	279	269	286	100
CP70-321	271	300	306	274	280	300	291	274	292	266	285	80
CP72-370	281	281	306	285	281	296	276	281	271	257	282	80
CP74-383	271	282	302	254	253	271	245	267	262	261	267	30
CP79-318	294	306	319	291	262	292	---	279	269	271	287	89
LCP82-089	277	299	322	280	266	289	283	287	275	257	284	80
LHo83-153	270	283	305	271	254	285	---	273	264	259	274	40
LCP85-384	275	300	310	285	282	297	294	290	280	284	290	90
CP85-845	274	276	299	293	274	287	---	270	264	260	277	67
LCP86-454	284	292	311	302	276	293	283	286	276	260	286	100
MEAN	278	291	310	282	270	289	279	280	273	264	282	80
$MSD_{.05}$	29	13	11	19	14	15	20	26	26	250	7	

[1] All.-A.V. Allain & Sons, E.H.-Evan Hall, Mag.-Magnolia, Oak.-Oaklawn, B.S.-Bon Secour, Cin.-Cinclare, F.P.-Frank Pearce & Sons, Geo.-Georgia, Lan.-Lanaux, R.H.-Ronald Hebert.

[2] Percentage of locations where the variety was not significantly less than the highest yielding variety at that location as determined with the minimum significant difference ($P < 0.05$).

Table 13. First ratoon stalk number based on plot weights for seven commercial and three experimental varieties at ten outfield locations in 1992.

Variety	Heavy textured soil locations				Light textured soil locations							NS from Best[2] %
	All.	E.H.	Mag.	Oak.	B.S.	Cin.	F.P.	Geo.	Lan.	R.H.	Mean	
	stalks/A											
CP65-357	21343	15311	21461	24005	27334	28221	-----	22739	19263	17699	21931	22
CP70-321	21329	23777	23795	22076	21731	26850	27360	22391	15338	23596	23082	20
CP72-370	19561	21677	21904	21538	25004	31302	25504	24912	13885	23583	23197	20
CP74-383	25680	21741	23098	22407	31067	27603	31407	24636	20135	28921	25860	50
CP79-318	20211	15565	14756	26619	28235	25419	-----	25591	20373	24427	22355	33
LCP82-089	22908	25401	26417	24546	26493	31684	19823	22258	20960	19355	24089	30
LHo83-153	28307	16818	25898	27848	28056	26673	-----	24575	20765	27545	25165	56
LCP85-384	34602	27515	19650	31754	39095	37357	34174	29524	25543	31970	31118	100
CP85-845	22110	24184	23956	25631	31157	28909	-----	28587	25183	27654	26375	56
LCP86-454	18463	20022	19912	20039	20764	23285	23061	20549	17841	19477	20326	10
MEAN	23451	21201	22085	24646	27894	28918	26888	24576	20388	24423	24399	40
$MSD_{.05}$	6915	5219	11150	3532	4245	5282	3745	7044	6102	7889	2562	

[1] All.-A.V. Allain & Sons, E.H.-Evan Hall, Mag.-Magnolia, Oak.-Oaklawn, B.S.-Bon Secour, Cin.-Cinclare, F.P.-Frank Pearce & Sons, Geo.-Georgia, Lan.-Lanaux, R.H.-Ronald Hebert.

[2] Percentage of locations where the variety was not significantly less than the highest yielding variety at that location as determined with the minimum significant difference ($P<0.05$).

Table 14. First ratoon stalk number based on stalk counts for seven commercial and three experimental varieties at ten outfield locations in 1992.

Variety	Heavy textured soil locations				Light textured soil locations							NS from Best[2] %
	All.[1]	E.H.	Mag.	Oak.	B.S.	Cin.	F.P.	Geo.	Lan.	R.H.	Mean	
	stalk/A											
CP65-357	21718	-----	17035	24743	24570	28674	-----	23626	17266	17382	21760	14
CP70-321	24917	-----	16997	26131	21101	26439	26477	24338	15436	21506	23016	13
CP72-370	23414	-----	16630	24801	28328	29696	28173	20716	14540	25379	23493	13
CP74-383	26497	-----	15994	32664	-----	27325	34552	23548	22055	28424	26571	13
CP79-318	20253	-----	14549	27923	-----	27711	-----	27441	19502	25476	23265	14
LCP82-089	24281	-----	21814	32432	-----	31565	29676	24107	23038	27595	26978	13
LHo83-153	28019	-----	19675	27537	-----	28655	-----	25283	21506	24512	25027	17
LCP85-384	38271	-----	25128	43224	-----	40757	44823	35593	28212	36094	36513	100
CP85-845	24358	-----	19367	25071	-----	27634	-----	25302	22257	23375	23909	14
LCP86-454	21930	-----	17151	24223	-----	26217	29195	19887	17546	20909	22155	13
MEAN	25366	-----	18434	28875	24642	29579	32149	24984	20458	25065	25346	13
$MSD_{.05}$	4389	-----	10943	5111	-----	6989	4112	5219	3311	5345	2087	

[1] All.-A.V. Allain & Sons, E.H.-Evan Hall, Mag.-Magnolia, Oak.-Oaklawn, B.S.-Bon Secour, Cin.-Cinclare, F.P.-Frank Pearce & Sons, Geo.-Georgia, Lan.-Lanaux, R.H.-Ronald Hebert.

[2] Percentage of locations where the variety was not significantly less than the highest yielding variety at that location as determined with the minimum significant difference ($P<0.05$).

Table 15. First ratoon stalk weights for seven commercial and three experimental varieties at ten outfield locations in 1992.

Variety	Heavy textured soil locations				Light textured soil locations							NS from Best[2] %
	All.[1]	E.H.	Mag.	Oak.	B.S.	Cin.	F.P.	Geo.	Lan.	R.H.	Mean	
	lbs.											
CP65-357	1.62	1.98	1.72	1.71	1.80	2.19	----	2.32	1.94	2.05	1.93	22
CP70-321	1.86	1.65	1.39	1.71	1.99	2.19	2.13	2.36	2.23	2.10	1.95	20
CP72-370	1.71	1.79	1.66	1.87	2.01	2.10	2.47	2.04	2.00	2.16	1.98	40
CP74-383	1.49	1.60	1.45	1.81	1.99	2.30	1.97	2.05	2.02	2.21	1.88	10
CP79-318	1.82	2.03	1.90	1.68	1.95	2.19	----	2.23	2.18	2.33	2.03	33
LCP82-089	1.66	1.60	1.56	1.76	1.65	1.88	2.14	2.32	1.97	1.81	1.83	0
LHo83-153	1.61	1.60	1.31	1.59	1.86	2.18	----	2.24	2.13	1.87	1.82	11
LCP85-384	1.50	1.52	1.36	1.52	1.66	1.93	1.95	1.97	1.80	1.87	1.71	0
CP85-845	1.62	1.72	1.52	1.62	1.79	2.13	----	2.04	1.87	1.92	1.80	0
LCP86-454	2.06	1.99	1.93	2.26	2.23	2.61	2.80	2.81	2.45	2.54	2.36	100
MEAN	1.70	1.75	1.58	1.75	1.89	2.15	2.24	2.24	2.05	2.09	1.93	20
$MSD_{.05}$	0.36	0.25	0.33	0.23	0.17	0.31	0.39	0.31	0.42	0.31	0.10	

[1] All.-A.V. Allain & Sons, E.H.-Evan Hall, Mag.-Magnolia, Oak.-Oaklawn, B.S.-Bon Secour, Cin.-Cinclare, F.P.-Frank Pearce & Sons, Geo.-Georgia, Lan.-Lanaux, R.H.-Ronald Hebert.

[2] Percentage of locations where the variety was not significantly less than the highest yielding variety at that location as determined with the minimum significant difference ($P < 0.05$).

Table 16. Second ratoon sucrose yield for seven commercial and two experimental varieties at five outfield locations in 1992.

Variety	Heavy textured soil locations		Light textured soil locations			Mean	NS from Best[2] %
	E.H.[1]	Oak.	B.S.	Geo.	R.H.		
	lbs/A						
CP65-357	3326	4568	7861	6742	3698	5239	60
CP70-321	4896	4725	5355	7210	5380	5513	40
CP72-370	4647	4854	----	----	----	4750	50
CP74-383	4045	4635	6744	6949	5772	5629	60
CP79-318	3944	4804	8216	8139	6390	6299	80
LCP82-089	4028	5037	7693	6569	4011	5467	60
LHo83-153	4619	5401	7667	8171	6155	6403	100
LCP85-384	4736	6359	8908	7604	6927	6907	100
CP85-845	4790	5572	7929	7449	5958	6340	100
MEAN	4337	5106	7547	7354	5536	5916	60
$MSD_{.05}$	NS	1055	1314	NS	1502	992	

[1] E.H.-Evan Hall, Oak.-Oaklawn, B.S.-Bon Secour, Geo.-Georgia, R.H.-Ronald Hebert.

[2] Percentage of locations where the variety was not significantly less than the highest yielding variety at that location as determined with the minimum significant difference ($P<0.05$).

Table 17. Second ratoon yield of cane for seven commercial and two experimental varieties at five outfield locations in 1992.

Variety	Heavy textured soil locations		Light textured soil locations			Mean	NS from Best[2] %
	E.H.[1]	Oak.	B.S.	Geo.	R.H.		
	tons/A						
CP65-357	11.7	16.2	27.3	23.0	13.2	18.2	40
CP70-321	16.5	17.5	20.8	25.1	20.0	20.0	60
CP72-370	16.8	17.4	----	----	----	17.1	50
CP74-383	15.1	17.4	27.5	26.2	22.0	21.6	80
CP79-318	13.4	17.4	29.7	28.0	22.9	22.3	80
LCP82-089	14.3	19.0	27.6	22.6	15.3	19.8	60
LHo83-153	16.8	20.5	28.1	29.4	23.1	23.6	100
LCP85-384	16.9	22.3	31.4	27.0	23.5	24.2	100
CP85-845	17.5	20.4	30.1	27.5	22.4	23.6	100
MEAN	15.4	18.7	27.8	26.1	20.3	21.4	80
$MSD_{.05}$	NS	3.2	3.9	7.9	5.6	2.9	

[1] E.H.-Evan Hall, Oak.-Oaklawn, B.S.-Bon Secour, Geo.-Georgia, R.H.-Ronald Hebert.

[2] Percentage of locations where the variety was not significantly less than the highest yielding variety at that location as determined with the minimum significant difference ($P<0.05$).

Table 18. Second ratoon theoretical sucrose content for seven commercial and two experimental varieties at five outfield locations in 1992.

Variety	Heavy textured soil locations		Light textured soil locations				NS from Best[2] %
	E.H.[1]	Oak.	B.S.	Geo.	R.H.		
	lbs/ton cane						
CP65-357	285	283	288	294	280	286	100
CP70-321	298	270	258	287	269	276	60
CP72-370	275	279	---	---	---	277	50
CP74-383	267	267	245	264	262	261	20
CP79-318	293	276	276	291	280	283	100
LCP82-089	282	265	279	291	263	276	80
LHo83-153	275	263	273	277	266	271	40
LCP85-384	280	286	283	282	294	285	100
CP85-845	276	273	263	271	266	270	40
MEAN	281	274	271	282	272	276	100
$MSD_{.05}$	18	32	26	14	22	11	

[1] E.H.-Evan Hall, Oak.-Oaklawn, B.S.-Bon Secour, Geo.-Georgia, R.H.-Ronald Hebert.

[2] Percentage of locations where the variety was not significantly less than the highest yielding variety at that location as determined with the minimum significant difference ($P < 0.05$).

Table 19. Second ratoon stalk number based on plot weights for seven commercial and two experimental varieties at five outfield locations in 1992.

Variety	Heavy textured soil locations		Light textured soil locations				NS from Best[2] %
	E.H.[1]	Oak.	B.S.	Geo.	R.H.		
	stalks/A						
CP65-357	16528	22849	30569	21532	16274	21551	20
CP70-321	20885	22518	21613	23854	21841	22142	60
CP72-370	21749	23361	-----	-----	-----	22555	50
CP74-383	19625	21131	29710	29132	20729	24065	60
CP79-318	16051	22419	32634	28621	23753	24696	80
LCP82-089	18835	24426	30125	23992	18077	23091	40
LHo83-153	27076	31561	32714	29871	26292	29503	100
LCP85-384	24893	36614	37875	29704	28352	31488	100
CP85-845	22713	25904	34608	28498	25830	27511	80
MEAN	20928	25642	31231	26901	22644	25365	60
$MSD_{.05}$	NS	5072	6239	6809	7773	3650	

[1] E.H.-Evan Hall, Oak.-Oaklawn, B.S.-Bon Secour, Geo.-Georgia, R.H.-Ronald Hebert.
[2] Percentage of locations where the variety was not significantly less than the highest yielding variety at that location as determined with the minimum significant difference ($P<0.05$).

Table 20. Second ratoon populations (no./A) based on stalk counts for seven commercial and two experimental varieties at five outfield locations in 1992.

Variety	Heavy textured soil locations		Light textured soil locations			Mean	NS from Best[2] %
	E.H.[1]	Oak.	B.S.	Geo.	R.H.		
CP65-357	----	20793	24589	24069	16149	21400	0
CP70-321	----	24377	18943	26497	21814	22908	25
CP72-370	----	27113	-----	-----	-----	27113	100
CP74-383	----	23356	25533	28154	22219	24512	25
CP79-318	----	26054	25745	23645	23067	24628	25
LCP82-089	----	27980	24994	25842	17748	24141	25
LHo83-153	----	30370	31353	25206	23914	27711	50
LCP85-384	----	34224	36402	43705	34918	37312	100
CP85-845	----	20176	28540	30312	24088	25779	25
MEAN	----	26049	27012	28441	22990	26097	50
$MSD_{.05}$	----	12724	9487	6516	10006	5008	

[1] E.H.-Evan Hall, Oak.-Oaklawn, B.S.-Bon Secour, Geo.-Georgia, R.H.-Ronald Hebert.
[2] Percentage of locations where the variety was not significantly less than the highest yielding variety at that location as determined with the minimum significant difference ($P<0.05$).

Table 21. Second ratoon stalk weights (lbs.) for seven commercial and two experimental varieties at five outfield locations in 1992.

Variety	Heavy textured soil locations		Light textured soil locations			Mean	NS from Best[2] %
	E.H.[1]	Oak.	B.S.	Geo.	R.H.		
CP65-357	1.40	1.42	1.80	2.13	1.62	1.68	40
CP70-321	1.58	1.58	1.97	2.10	1.85	1.82	100
CP72-370	1.54	1.49	----	----	----	1.52	100
CP74-383	1.53	1.64	1.85	1.81	2.12	1.79	80
CP79-318	1.72	1.56	1.82	1.96	1.95	1.80	100
LCP82-089	1.55	1.57	1.83	1.88	1.72	1.71	80
LHo83-153	1.28	1.30	1.73	1.97	1.76	1.61	40
LCP85-384	1.38	1.23	1.67	1.82	1.66	1.55	20
CP85-845	1.55	1.58	1.77	1.93	1.77	1.72	80
MEAN	1.50	1.48	1.81	1.95	1.81	1.70	80
$MSD_{.05}$	0.25	0.16	1.50	0.26	0.28	0.16	

[1] E.H.-Evan Hall, Oak.-Oaklawn, B.S.-Bon Secour, Geo.-Georgia, R.H.-Ronald Hebert.

[2] Percentage of locations where the variety was not significantly less than the highest yielding variety at that location as determined with the minimum significant difference ($P<0.05$).

Table 22. Combined plant cane means across outfield locations from 1990 through 1992.

Variety	Tests[1]	Sucrose yield			Cane yield			Sucrose content			Stalk no.			Stalk weight		
		Mean	NS from best[2]		Mean	NS from best		Mean	NS from best		Mean	NS from best		Mean	NS from Best	
	no	lbs/A	%	no	T/A	%	no	lbs/T	%	no	no/A	%	no	lbs	%	no
CP65-357	31	6538	58 ±9	18	24.9	58 ±9	18	264	61 ±9	19	19599	23 ±8	7	2.55	29 ±8	9
CP70-321	31	6305	45 ±9	14	24.3	29 ±8	9	259	42 ±9	14	19461	16 ±7	5	2.51	26 ±8	8
CP74-383	31	6454	52 ±9	16	26.3	74 ±8	23	246	10 ±5	3	21249	26 ±8	8	2.48	23 ±8	7
CP79-318	31	6613	65 ±9	20	25.2	65 ±9	20	263	55 ±9	17	18673	10 ±5	3	2.71	48 ±9	15
LCP82-089	31	6545	55 ±9	17	25.4	61 ±9	19	259	45 ±9	14	20466	39 ±9	12	2.49	13 ±6	4
LHo83-153	31	6435	45 ±9	14	26.0	77 ±8	24	247	10 ±5	3	23159	58 ±9	18	2.24	0 ±2	0
LCP85-384	31	7471	100 ±2	31	28.0	100 ±2	31	267	64 ±9	20	25691	90 ±5	28	2.19	0 ±2	0
CP85-845	31	6868	71 ±8	22	27.5	90 ±5	28	250	16 ±7	5	23072	61 ±9	17	2.39	6 ±4	2
$MSD_{.05}$		301			1.1			5			962			0.07		

1 Based upon 31 plantcane outfield tests harvested in 1990, 1991 and 1992.

2 Percent of total tests and number of tests the variety was not significantly different from the best variety for that trait in that test.

Table 23. Combined first ratoon means across outfield locations from 1991 through 1992.

Variety	Tests[1]	Sucrose yield			Cane yield			Sucrose content			Stalk no.			Stalk weight		
		Mean	NS from best[2]		Mean	NS from best		Mean	NS from best		Mean	NS from best		Mean	NS from best	
	no	lbs/A	%	no	T/A	%	no	lbs/T	%	no	no/A	%	no	lbs	%	no
CP65-357	18	5484	39 ±11	7	20.0	44 ±11	8	274	94 ±6	17	20420	11 ±7	2	1.96	44 ±11	8
CP70-321	19	5704	37 ±11	7	21.5	53 ±11	10	264	58 ±11	11	22166	21 ±9	4	1.95	32 ±11	6
CP74-383	19	5906	32 ±11	6	23.6	79 ±10	15	252	21 ±9	4	24073	32 ±11	6	1.97	42 ±11	8
CP79-318	18	6100	61 ±11	11	22.3	56 ±11	10	275	78 ±10	14	21211	22 ±10	4	2.10	67 ±11	12
LCP82-089	19	5947	47 ±11	9	21.6	53 ±11	10	274	84 ±8	16	23709	21 ±10	4	1.85	26 ±10	5
LHo83-153	18	5835	56 ±12	10	22.5	61 ±11	11	259	28 ±11	5	25046	50 ±11	8	1.80	22 ±10	4
LCP85-384	19	7043	89 ±17	17	25.6	95 ±5	18	275	74 ±10	14	31196	100 ±2	19	1.64	0 ±2	0
CP85-845	18	6073	56 ±12	10	23.5	67 ±11	12	258	44 ±11	8	24844	39 ±11	7	1.89	33 ±11	6
$MSD_{.05}$		440						6			1656			0.08		

1 Based upon first ratoon outfield tests harvested in 1991 and 1992.

2 Percent of total tests and number of tests the variety was not significantly different from the best variety for that trait in that test.

Table 24. Second ratoon means across 1992 outfield locations.

Variety	Tests[1]	Sucrose yield			Cane yield			Sucrose content			Stalk no.			Stalk weight		
		Mean	NS from best[2]		Mean	NS from best		Mean	NS from best		Mean	NS from best		Mean	NS from best	
	no	lbs/A	%	no	T/A	%	no	lbs/T	%	no	no/A	%	no	lbs	%	no
CP65-357	5	5239	60 ±22	3	18.2	40 ±22	2	286	100 ±4	5	21551	20 ±18	1	1.68	40 ±22	2
CP70-321	5	5513	40 ±22	2	20.0	60 ±22	3	276	60 ±22	3	22142	60 ±22	3	1.82	100 ±4	5
CP74-383	5	5629	60 ±22	3	21.6	80 ±18	4	277	20 ±18	1	24065	60 ±22	3	1.79	80 ±18	4
CP79-318	5	6299	80 ±18	4	22.3	80 ±18	4	261	100 ±4	5	24696	80 ±18	4	1.80	100 ±4	5
LCP82-089	5	5467	60 ±22	3	19.8	60 ±22	3	283	80 ±18	4	23091	40 ±22	2	1.71	80 ±18	4
LHo83-153	5	6403	100 ±4	5	23.6	100 ±4	5	276	40 ±22	2	29503	100 ±4	5	1.61	40 ±22	2
LCP85-384	5	6907	100 ±4	5	24.2	100 ±4	5	271	100 ±4	5	31488	100 ±4	5	1.55	20 ±18	1
CP85-845	5	6340	100 ±4	5	23.6	100 ±4	5	285	40 ±22	2	27511	80 ±18	4	1.72	80 ±18	4
MEAN		5916	60 ±22	3	21.4	80 ±18	4	270	100 ±4	5	25365	60 ±22	3	1.70	80 ±18	4
$MSD_{.05}$		992			2.9			11			3650			0.16		

1 Based upon first ratoon outfield tests harvested in 1991 and 1992.

2 Percent of total tests and number of tests the variety was not significantly different from the best variety for that trait in that test.

Table 25. Combined plant cane means across locations from 1991 through 1992.

	Sucrose yield		Cane yield		Sucrose content		Stalk no.		Stalk weight	
Variety	Mean	%Best	Mean	%Best	Mean	%Best	Mean	%Best	Mean	%Best
	lbs/A		tons/A		lbs/ton		no./A		lbs	
CP65-357	6239	59	23.3	50	268	82	19177	18	2.44	27
CP70-321	5764	47	22.4	23	257	45	19039	13	2.37	18
CP72-370	6272	59	23.9	50	262	59	20092	18	2.40	14
CP74-383	6147	55	25.0	73	246	13	20816	27	2.40	23
CP79-318	6244	63	23.5	59	266	73	17894	9	2.63	50
LCP82-089	6276	64	23.9	59	263	64	20194	41	2.38	13
LHo83-153	6120	50	24.6	77	248	14	22620	50	2.17	0
LCP85-384	7082	100	26.3	100	268	82	24932	86	2.13	0
CP85-845	6559	77	26.0	91	251	23	22514	54	2.31	5
LCP86-454	6613	77	25.1	76	264	63	16866	10	2.98	100
$MSD_{.05}$	383		1.3		5		1170		0.08	

Table 26. The number and (percentage) of plant cane outfield observations in which the variety was rated in the designated category of post-harvest scrap during 1992.

Variety	None	Little	Some	Much	Very Much	Total
CP65-357	8 (24)	9 (27)	9 (27)	5 (15)	2 (6)	33
CP70-321	10 (31)	10 (31)	8 (25)	4 (13)	0 (0)	32
CP72-370	7 (21)	11 (33)	6 (18)	8 (24)	1 (3)	33
CP74-383	6 (19)	8 (25)	11 (34)	7 (22)	0 (0)	32
CP79-318	4 (13)	10 (31)	6 (19)	7 (22)	5 (16)	32
LCP82-089	3 (9)	13 (41)	8 (25)	6 (19)	2 (6)	32
LHo83-153	10 (30)	8 (24)	13 (39)	2 (6)	0 (0)	33
LCP85-384	5 (15)	9 (27)	10 (30)	4 (12)	5 (15)	33
CP85-845	6 (18)	11 (33)	13 (39)	2 (6)	1 (3)	33
LCP86-454	9 (27)	8 (24)	9 (27)	5 (15)	2 (6)	33
LCP87-017	7 (21)	11 (33)	10 (30)	3 (9)	2 (6)	33
LCP87-491	3 (9)	10 (30)	10 (30)	6 (18)	4 (12)	33
Total	78	118	113	59	24	392

Table 27. The number and (percentage) of first ratoon outfield observations in which the variety was rated in the designated category of post-harvest scrap during 1992.

Variety	None	Little	Some	Much	Very Much	Total
CP65-357	2 (8)	12 (50)	10 (42)	0 (0)	0 (0)	24
CP70-321	3 (12)	11 (42)	8 (31)	3 (12)	1 (4)	26
CP72-370	3 (12)	11 (42)	7 (27)	3 (12)	2 (8)	26
CP74-383	0 (0)	6 (23)	12 (46)	7 (27)	1 (4)	26
CP79-318	0 (0)	8 (33)	5 (21)	9 (38)	2 (8)	24
LCP82-089	2 (8)	10 (38)	9 (35)	2 (8)	3 (12)	26
LHo83-153	2 (8)	13 (54)	8 (33)	1 (4)	0 (0)	24
LCP85-384	0 (0)	4 (15)	9 (33)	11 (41)	3 (11)	27
CP85-845	3 (13)	10 (42)	6 (25)	4 (17)	1 (4)	24
LCP86-454	4 (16)	7 (28)	6 (24)	6 (24)	2 (8)	25
Total	19	92	80	46	15	252

Table 28. The number and (percentage) of second ratoon outfield observations in which the variety was rated in the designated category of post-harvest scrap during 1992.

Variety	None	Little	Some	Much	Very Much	Total
CP65-357	5 (33)	6 (40)	2 (13)	1 (7)	1 (7)	15
CP70-321	1 (7)	7 (47)	5 (33)	2 (13)	0 (0)	15
CP72-370	3 (50)	1 (17)	2 (33)	0 (0)	0 (0)	6
CP74-383	1 (7)	4 (27)	9 (60)	0 (0)	1 (7)	15
CP79-318	2 (13)	1 (7)	7 (47)	4 (27)	1 (7)	15
LCP82-089	3 (20)	3 (20)	6 (40)	3 (20)	0 (0)	15
LHo83-153	3 (20)	7 (47)	4 (27)	1 (7)	0 (0)	15
LCP85-384	2 (13)	2 (13)	2 (13)	4 (27)	5 (33)	15
CP85-845	3 (20)	9 (60)	2 (13)	0 (0)	1 (7)	15
Total	23	40	39	15	9	126

Table 29. The number and (percentage) of outfield observations in which the variety was rated in the designated category of post-harvest scrap during 1992.

Variety	None	Little	Some	Much	Very Much	Total
CP65-357	15 (21)	27 (38)	21 (29)	6 (8)	3 (4)	72
CP70-321	14 (19)	28 (38)	21 (29)	9 (12)	1 (1)	73
CP72-370	13 (20)	23 (35)	15 (23)	11 (17)	3 (5)	65
CP74-383	7 (10)	18 (25)	32 (44)	14 (19)	2 (3)	73
CP79-318	6 (8)	19 (27)	18 (25)	20 (28)	8 (11)	71
LCP82-089	8 (11)	26 (36)	23 (32)	11 (15)	5 (7)	73
LHo83-153	15 (21)	28 (39)	25 (35)	4 (6)	0 (0)	72
LCP85-384	7 (9)	15 (20)	21 (28)	19 (25)	13 (17)	75
CP85-845	12 (17)	30 (42)	21 (29)	6 (8)	3 (4)	72
LCP86-454	13 (22)	15 (26)	15 (26)	11 (19)	4 (7)	58
LCP87-017	7 (21)	11 (33)	10 (30)	3 (9)	2 (6)	33
LCP87-491	3 (9)	10 (30)	10 (30)	6 (18)	4 (12)	33
Total	120 (16)	250 (32)	232 (30)	120 (16)	48 (6)	770

IMPLEMENTATION OF A CROSS APPRAISAL SYSTEM WITHIN THE LOUISIANA SUGARCANE VARIETY DEVELOPMENT PROGRAM

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SUMMARY:

We measured cane yield components of 236 replicated families, which represent a balanced subset of 256 families, to evaluate their potential to produce superior offspring. A random subpopulation of 25 clones were further evaluated to obtain among family, within family and, where appropriate, within plant variance components. Among family variance components for stalk number per stool and stool weight were negative. We used variance components of stalk height, stalk diameter and stalk weight to estimate potential genetic gain for various selection combinations among and within families. The results indicate not to use family selection for stalk height. Stalk diameter and stalk weight selection should, however greatly benefit from using family selection practices.

OBJECTIVE:

The objective is to develop practical methodology to conduct and use data from a cross appraisal system. We strive to verify reported utilities of various analytical statistics and to develop selection guidelines for among and within family selection.

INTRODUCTION:

The Louisiana Sugarcane Variety Development Program currently uses 13 years from the initial crossing of parents until the year of variety release to develop new varieties. Each year, program personnel plant up to 75,000 seedlings from about two hundred different crosses with the hopes of selecting, testing, and releasing one superior variety. The initial stage of crossing involves considerable work and decision making. The process encompasses choice of parents, greenhouse culture, photoperiod and temperature control, air layering (marcotting) of the stalks to enable physical convergence of the tassels, and crossing decisions based upon parental qualities and percent advancement knowledge. Percent advancement data is the percentage of each cross's progeny selected and advanced through the first four stages of selection. This process is time consuming, of questionable value, and available for only a limited number of crosses. Crossing decisions are further constrained by pollen fertility and flower availability. Photoperiod requirements to make each genotype flower vary and must be individually characterized to synchronize flowering with other clones. This characterization requires a minimum of one year, and more commonly two or three years of culture and testing. Hence, the making of a sugarcane cross incurs considerable time and expense.

MATERIALS AND METHODS:

Research personnel at the St. Gabriel Research Station in St. Gabriel, LA grew sugarcane seedlings in Speedling™ trays under greenhouse conditions from January to April during 1991

and 1992. The seedlings from 256 crosses were transplanted to the field in a randomized complete block design using two blocks in May and April, respectively. Progeny from the crosses were planted in plots of paired rows 1.8m apart. Each row was 4.8m long with a 1.2m space between plots and 0.4m between individual seedlings giving up to 16 plants per row and 32 plants per plot. The plan was to collect yield component data from the plant cane plants in November of each year, but early November freezes in 1991 and Hurricane Andrew in August 1992 prevented the data collection. Stalk number, stool number, and the number of smutted stalks was determined in August 1992 on an individual row within plot basis. Stalk height was measured to the top visible dewlap on five randomly chosen stalks from different plants within in each row in each plot and block for a total of 20 observations per cross. The stalk diameter was recorded with a caliper at the bud groove near the middle of each of 20 randomly chosen stalks per cross in the same manner as with diameter. Individual measurements of height and diameter were from different plants within the plot. Stalk weight and stool weight were estimated by assuming the stalk a cylinder with the stalk density equal to one. Research has confirmed this assumption.

With the cooperation of USDA-ARS personnel, 50 crosses were planted on their Ardoyne Farm near Chacahoula, LA. These crosses were planted in paired rows 1.8m apart using up to 32 plants per row and 64 per plot. Plants were planted 46cm apart. Stalk number, stool number, and the number of smutted stalks was determined in August 1992 on an individual row within plot basis. Further data collection on these 50 crosses was halted by Hurricane Andrew.

To explore the within family variance and the relationships among the individual plant data, seedling family data, and clonal family data, twenty-five crosses were randomly chosen from the original 256 crosses. Sequentially within each row of the selected families, stalks per stool were recorded until five stools with at least four stalks were observed. In the stools with at least four stalks, three random stalks per stool were measured for individual height and diameter. Four stalks from each of the twenty plants measured from each family that had at least four stalks per stool were planted into a randomized complete block design using two replications. One block was in a Sharkey clay (very-fine, montmorillonitic, nonacid, thermic Vertic Haplaquepts) and the other block was in a Commerce silt loam (fine-silty, mixed, nonacid, thermic Aeric Fluvaquents) at the St. Gabriel Research Station.

Assuming a fully random model, mean squares of balanced data using 236 families were equated to expectations to obtain variance components. When possible, genetic advance (GA) for various selection scenarios for among and within family selection were calculated using the equation:

$$GA_{individual} = i_w\sigma_{PBCR}^2/(\sigma_C^2 + \sigma_{BC}^2 + \sigma_{RBC}^2 + \sigma_{PBCR}^2 + \sigma^2)^{1/2}$$

$$GA_{combined} = GA_{among\ fam} + GA_{within\ fam} = i_f\sigma_C^2/\sigma_{Pf} + i_w\sigma_{PBCR}^2/\sigma_{Pw}$$

$$\sigma_{Pf}^2 = \text{family phenotypic variance} = \sigma_C^2 + \sigma_{BC}^2/b + \sigma_{RBC}^2/rb + \sigma_{PBCR}^2/prb + \sigma^2/sprb$$

$$\sigma_{Pw}^2 = \text{within family phenotypic variance} = \sigma_{BC}^2 + \sigma_{RBC}^2 + \sigma_{PBCR}^2 + \sigma^2$$

i_f = standardized among family selection coefficient,
i_w = standardized within family selection coefficient,
σ_C^2 = cross variance = among family variance,
σ_{BC}^2 = block by cross variance,
σ_{RBC}^2 = row(block cross) variance,
σ_{PBCR}^2 = plant(block row cross) = within family variance,
σ^2 = residual or error variance = within plant variance,
b = the number of blocks,
r = the number of rows,
p = the number of plants,
s = the number of stalks.

Selection rates were chosen to make the combined selection rate equal 10% either on a combined among family and within selected families or on an individual plant basis with no reference to family. Selection coefficients assumed population sizes of 225 families and 225 individuals within families, which are typical values for the breeding program.

The potential of a family to produce elite progreny was estimated by the probability (PROB) statistic. It assumed a normal distribution for the observations in this study and was estimated using the Z parameter for normal probability (Steel and Torrie 1980) as:

$$PROB = Prob[Z > (target\text{-}mean_i)/s_i]$$

where the $mean_i$ and s_i were the family mean and standard deviation, respectively, of family *i*. The target values were equated to the population mean to distinguish the family potential of producing elite lines. A SAS function, PROBNORM (SAS 1985), was used to calculate PROB. For example, assume family *i* produced an average of 10 ± 2 stalks per square meter. Let the target be 13 stalks per square meter. Then

$$Z_i = (13\text{-}10)/2 = 0.667$$
$$PROB(Z > 0.667) \approx 0.25$$

or about 25% of the progeny of family *i* should produce 13 or more stalks per square meter.

RESULTS and DISCUSSION:

Variance components for stalk height and diameter based upon the full 236 family test indicated that cross effects were significant but the residual error effects ranged from 7 to 16 times more important (Table 1). The residual error in this test confounds plant within family variance, the within plant variance and measurement error. Stalk height appeared more affected by cross by environment variation, as indicated by the σ_{BC}^2 and σ_{RBC}^2 components, than the stalk diameter. Even this is very likely an underestimate of cross by environment interaction effects since the test was conducted at only one location and year.

Analysis of the 236 families, which represent a balanced subset of 256 families, for stalks per stool, stalk weight and stool weight also suggested cross effects were significant (Table 2).

Block by cross interaction illustrated the largest influence for stalks per stool suggesting it was the largest source of error in measuring this trait. A large error component for stalk weight five times outweighed cross variance whereas cross and cross by block variances essentially equalled each other in magnitude and were approximately half the error variance for stool weight. This suggested gains could be made by family selection but efforts to replicate would render significantly better results.

We measured a random subsample of 25 families to better estimate the relative importance of within family variance compared to among family variation. We equated σ_{PBCR}^2 to the within family variance (Table 3). Error variance (σ^2) in this table confounded within plant variance and measurement error. Within family variance (σ_{PBCR}^2) was 11 times the magnitude of the among family variance for stalk height and about equal in magnitude to the within plant variance (σ^2). Cross variance was quite small for this trait. This was quite different from the variances estimated for stalk diameter where the among family variance was considerably larger than that for individuals within a family. The within family variances for stalk weight were more important than the among family variances while the within plant variance (σ^2) was the largest source of variation.

Family variances component estimates for stalks per stool and stool weight were negative for the 25 family subsample (Table 4). Causes of negative variance components include a value of zero or near zero, or an incorrect model. Since the components for these traits were positive in the entire population estimate (Table 2), they are likely greater than zero but the estimate was by chance less than zero. We assume the model is correct.

Genetic gain estimates for stalk height, stalk diameter and stalk weight were made to compare some combinations of among and within family selection situations as shown in Table 5. No estimates were made for stalk number per stool or stool weight due to the negative family estimates. The estimated gains suggest family selection would be beneficial for stalk diameter and stalk weight but not for stalk height. They also suggest replication as performed in this study would improve gains. The estimated gains suggest strict among family selection for stalk diameter would produce the best gains while a loose family selection for stalk weight would produce the best gains. Optional balance among and within family selection was not obtained.

Family means, standard deviations of individuals clones within family and the probability of exceeding the overall mean value for stool weight and stalks per stool for the 25 randomly selected families is shown in Table 6.

Family means, standard deviations of individuals clones within family, standard diviation of stalks within stool, and the probability of exceeding the overall mean value for stalk weight, stalk diameter, and stalk height for the 25 randomly selected families is shown in Table 7.

A summary of individual cross performances for the first ratoon 1991 crossing series is shown in Table 8. Individual family means $\pm$ individual standard deviations of the family mean values (standard deviation among the four row mean numbers) are given for stool weight, stalks per stool, stalk weight, stalk diameter, and stalk height. The number of smutted stalks is also included.

First ratoon seedling mean and standard deviations for stalks per stool of family row mean and smutted stalks for 50 crosses grown at the Ardoyne Farm in 1992 are given in Table 9.

Information on the time needed to complete field data collection was recorded to enable future cost-benefit analysis and planning for labor and time to collect such data. Man hours to collect field data on stalk number, stool number, stalk height, and stalk diameter for the 256 crosses is given in Table 10. Table 11 contains the man hours amassed to collect data on stalk per stool, stalk height, and stalk diameter on the 25 randomly chosen families. One should note the almost doubled time requirement for block 2 data which was collected after Hurricane Andrew.

REFERENCES:

Steel, R.G.D, Torrie, J.H. 1980. Principles and procedures of statistics a biometrical approach. McGraw-Hill, New York.

SAS Institute Inc. 1985. SAS user's guide:basics, version 5 ed. SAS Institute, Cary H.C.

Table 1. Stalk height and stalk diameter mean squares and variance components for 236 families from the 1990 crossing series collected from first ratoon crop seedlings in 1992.

Source	df	Stalk height		Stalk diameter		Expected mean squares[a]
		mean sq	VC[b]	mean sq.	VC $x10^{-2}$	
		--------- cm^2 ---------		---------- mm^2 ----------		
Block	1	655279	-	1.56	-	-
Cross	235	4582*	118.6	34.95*	77.12	$\sigma^2 + p\sigma_{RBC}^2 + pr\sigma_{BC}^2 + prb\sigma_C^2$
Block x cross	235	2210*	100.2	19.53	7.83	$\sigma^2 + p\sigma_{RBC}^2 + pr\sigma_{BC}^2$
Row(block cross)	472	1208*	92.4	18.74*	1.24	$\sigma^2 + p\sigma_{RBC}^2$
Error	3776	746	745.8	12.54	1254.17	σ^2

a p = no. of plants = 5; b = no of blocks = 2; r = no. of rows = 2. b VC - variance component.
* significantly different at $\alpha = 0.01$.

Table 2. Stalk per stool, stool weight and stalk weight mean squares and variance components for 236 families from the 1990 crossing series collected from first ratoon crop seedlings in 1992.

Source	df	Stalks per stool		Stalk weight		Stool weight		Expected mean squares[a]
		mean sq.	VC[b]	mean sq.	VC	mean sq.	VC	
		--------- $no.^2$ ---------		--------- kg^2 --------		--------- kg^2 --------		
Block	1	568.79	-	11.5	-	1685.20	-	-
Cross	235	15.09*	1.20	21.7*	2.56	21.23*	2.74	$\sigma^2 + r\sigma_{BC}^2 + rb\sigma_C^2$
Block x cross	235	10.30*	4.71	11.5	0.54	11.33*	2.87	$\sigma^2 + r\sigma_{BC}^2$
Error	4248	0.89	0.89	10.4	10.41	5.59	5.59	σ^2

a r = no. of rows = 2; b = no. of blocks = 2. b VC - variance component.
* significantly different at $\alpha = 0.01$

Table 3. Stalk height, stalk diameter and stalk weight mean squares and variance components for 25 randomly selected families from the 1990 crossing series collected from first ratoon crop seedlings in 1992.

Source	df	Stalk height		Stalk diameter		Stalk weight		Expected mean squares[a]
		MS[b]	VC	MS	VCx10^{-2}	MS x10^{-2}	VCx10^{-3}	
		--------- cm^2 ----------		------- mm^2 -------		-------- kg^2 --------		
Block	1	26586	-	25.27	-	79.67	-	-
Cross	24	12620	46.5	75.30**	73.26	45.81	1.31	$\sigma^2+s\sigma_{PBCR}^2+sp\sigma_{RBC}^2+spr\sigma_{BC}^2+sprb\sigma_C^2$
Block x cross	24	9832*	243.5	31.34	18.77	37.97**	6.37	$\sigma^2+s\sigma_{PBCR}^2+sp\sigma_{RBC}^2+spr\sigma_{BC}^2$
Row(block cross)	50	2526	38.4	25.71	24.42	18.85	2.73	$\sigma^2+s\sigma_{PBCR}^2+sp\sigma_{RBC}^2$
Plant(block row cross)	400	1949*	497.0	22.04*	4.57	14.76*	7.53	$\sigma^2+s\sigma_{PBCR}^2$
Error	1000	458	458.0	8.35	834.58	6.53	65.32	σ^2

a p = no. of plants = 5; b = no. of blocks = 2; r = no. of rows = 2.
b MS - mean sq.; VC - variance component.
* significantly different at $\alpha = 0.01$.
** significantly different at $\alpha = 0.05$

Table 4. Stalks per stool and stool weight mean squares and variance components for 25 randomly selected families from the 1990 crossing series collected from first ratoon crop seedlings in 1992.

Source	df	Stalks per stool		Stool weight		Expected mean squares[a]
		MS[b]	VC	MS	VC X 10^2	
		---------- $no.^2$ ---------		--------- kg^2 -------		
Block	1	73.93	-	2.02	-	-
Cross	24	54.26	-1.20	57.09	-2.10	$\sigma^2 + p\sigma_{RBC}^2 + pr\sigma_{BC}^2 + prb\sigma_C^2$
Block x cross	24	78.16*	5.72	98.99*	6.86	$\sigma^2 + p\sigma_{RBC}^2 + pr\sigma_{BC}^2$
Row(block cross)	50	20.96*	3.98	30.40*	3.42	$\sigma^2 + p\sigma_{RBC}^2$
Error	1400	1.07	1.07	13.33	13.33	σ^2

a p = no. of plants = 3; b = no. of blocks = 2; r = no. of rows = 2. b MS - mean sq.; VC - variance component.
* significantly different at $\alpha = 0.01$

Table 5. Genetic advance estimates for a combined among and within family selection, and individual mass selection expressed as percent of gains of individual mass selection[a].

Trait	Individual 10% plant	75% Family 13.3% Individual		50% Family 20% Individual		25% Family 40% Individual	
		rep.[b]	no rep.	rep.	no rep.	rep.	no rep.
	---------- percent individual 10% with no prior family selection ----------						
Stalk height	100.0	47.2	46.9	43.7	43.0	34.7	33.6
Stalk diameter	100.0	458.2	379.4	896.2	734.0	1432.6	1167.6
Stalk weight	100.0	870.1	766.9	881.8	669.6	816.4	469.6

a Based upon variance components from Table 3.
b Assumed replication used in experiment (2 blocks, 2 rows, 5 plants, 3 stalks within plant).

Table 6. Family means, standard deviation of individual clones within a family, and the probability of exceeding the overall mean value for stool weight and stalks per stool for 25 families.

Cross	Female	Male	Stool wt.			Stalks per stool		
			fam mean	w/in fam std	prob	fam mean	w/in fam std	prob
			----- kg -----		%	--- number ---		%
XL85-182	CP65-357	CP70-321	6.96	4.24	56	8.45	5.40	49
XL85-218	CP80-328	CP70-321	5.71	4.80	45	7.48	3.90	39
XL85-251	CP48-103	CP69-1052	6.61	4.87	52	8.45	4.30	49
XL87-256	LCP84-215	LCP81-030	6.30	3.54	49	8.73	4.08	52
XL88-238	CP79-332	CP78-357	5.19	3.46	37	9.11	4.34	55
XL88-304	CP80-323	LCP82-047	6.21	3.98	48	7.70	3.43	40
XL89-462	CP79-348	CP80-323	7.96	3.75	66	8.30	3.22	47
XL90-006	LCP87-017	LCP87-472	5.14	3.88	38	8.05	2.91	43
XL90-044	CP65-357	LCP85-384	6.20	4.33	48	8.40	3.70	48
XL90-079	LCP81-015	L88-075	6.16	3.12	47	7.90	2.70	41
XL90-088	CP74-383	LCP87-496	5.32	2.94	36	7.77	3.08	40
XL90-094	CP77-405	90P1	4.42	2.67	23	5.71	1.75	5
XL90-163	LCP86-429	LCP87-496	6.07	5.13	48	8.95	4.37	54
XL90-206	CP70-330	LCP87-023	7.38	3.51	61	8.78	3.41	53
XL90-207	CP75-361	LCP87-023	8.15	3.61	69	9.75	3.96	62
XL90-217	CP75-361	CP70-321	4.98	2.60	30	6.87	2.35	24
XL90-234	CP65-357	CP87-657	7.78	4.83	62	9.23	3.57	58
XL90-240	CP77-405	CP73-343	6.97	4.62	55	9.08	4.87	54
XL90-253	CP78-317	US77-010	7.33	3.23	62	8.22	3.27	46
XL90-266	CP75-361	CP82-550	6.56	3.86	52	8.70	3.55	52
XL90-268	CP83-644	CP77-310	7.41	4.29	60	9.00	3.96	55
XL90-277	LCP86-408	LCP85-384	5.58	3.83	42	9.42	3.20	61
XL90-284	LCP81-030	LCP86-393	6.49	4.27	51	7.25	3.47	35
XL90-310	CP75-361	CP80-323	5.82	3.25	43	7.33	3.14	35
XL90-329	LCP85-336	90P3	6.46	3.65	51	8.92	2.81	55
MEAN			6.37	3.85	50	8.30	3.55	50

Table 7. Family means, standard deviation of individual clones within family, standard deviation of stalks within stool, and the probability of exceeding the overall mean value for stalk weight, stalk diameter and stalk height for 25 families.

Cross	Female	Male	Stalk Weight				Stalk Diameter				Stalk Height			
			fam mean	w/in fam std	w/in stool std	prob	fam mean	w/in fam std	w/in stool std	prob	fam mean	w/in fam std	w/in stool std	prob
			-------- kg ----------			%	-------- mm --------			%	-------- cm --------			%
XL85-182	CP65-357	CP70-321	0.798	0.273	0.196	59	23.0	3.20	2.31	57	186	29.5	18.16	62
XL85-218	CP80-328	CP70-321	0.714	0.375	0.231	47	21.6	4.31	3.12	42	181	37.1	21.20	54
XL85-251	CP48-103	CP69-1052	0.701	0.308	0.180	45	22.0	3.93	2.25	45	173	34.9	20.92	46
XL87-256	LCP84-215	LCP81-030	0.730	0.353	0.202	49	21.9	4.45	2.98	45	180	36.1	13.65	53
XL88-238	CP79-332	CP78-357	0.547	0.222	0.167	20	19.2	3.39	2.29	16	182	27.6	18.54	58
XL88-304	CP80-323	LCP82-047	0.778	0.358	0.236	54	22.7	3.68	2.87	52	181	45.1	22.91	54
XL89-462	CP79-348	CP80-323	0.881	0.296	0.203	69	25.1	3.18	2.26	80	173	23.1	12.38	44
XL90-006	LCP87-017	LCP87-472	0.586	0.272	0.148	29	21.7	3.29	2.30	40	151	34.3	17.47	22
XL90-044	CP65-357	LCP85-384	0.717	0.301	0.192	47	21.7	3.38	2.24	41	184	35.9	22.19	59
XL90-079	LCP81-015	L88-075	0.781	0.297	0.186	56	22.4	3.52	2.15	49	190	32.7	17.62	66
XL90-088	CP74-383	LCP87-496	0.679	0.276	0.180	42	22.5	3.29	2.40	50	163	29.4	18.44	32
XL90-094	CP77-405	90P1	0.742	0.347	0.273	50	22.9	4.14	3.42	55	167	35.8	21.47	39
XL90-163	LCP86-429	LCP87-496	0.644	0.355	0.186	39	22.7	4.14	2.20	53	146	48.2	19.05	26
XL90-206	CP70-330	LCP87-023	0.814	0.309	0.165	60	23.4	3.40	1.96	61	182	34.4	21.01	56
XL90-207	CP75-361	LCP87-023	0.830	0.291	0.228	62	22.9	3.32	2.32	55	197	32.3	19.66	73
XL90-217	CP75-361	CP70-321	0.723	0.319	0.183	48	23.1	3.08	2.48	58	167	41.6	15.54	41
XL90-234	CP65-357	CP87-657	0.808	0.352	0.209	58	23.2	3.53	2.51	58	181	32.2	14.26	56
XL90-240	CP77-405	CP73-343	0.716	0.302	0.182	47	23.1	3.81	2.46	57	160	26.4	13.05	27

Table 7. continued.

Cross	Female	Male	Stalk Weight				Stalk Diameter				Stalk Height			
			fam mean	w/in fam std	w/in stool std	prob	fam mean	w/in fam std	w/in stool std	prob	fam mean	w/in fam std	w/in stool std	prob
			-------- kg ----------			%	-------- mm --------			%	-------- cm --------			%
XL90-253	CP78-317	US77-010	0.857	0.283	0.241	66	22.6	3.23	2.70	51	207	27.0	18.69	87
XL90-266	CP75-361	CP82-550	0.739	0.290	0.157	50	21.7	3.56	2.12	42	191	22.4	15.42	73
XL90-268	CP83-644	CP77-310	0.785	0.296	0.164	56	22.6	3.22	2.19	51	188	31.0	12.19	65
XL90-277	LCP86-408	LCP85-384	0.553	0.244	0.153	22	20.8	3.12	2.46	30	153	30.3	12.47	22
XL90-284	LCP81-030	LCP86-393	0.814	0.320	0.192	59	24.0	3.93	2.58	65	172	30.7	16.04	44
XL90-310	CP75-361	CP80-323	0.802	0.367	0.180	57	23.1	3.74	2.38	57	183	29.5	12.49	59
XL90-329	LCP85-336	90P3	0.711	0.341	0.206	47	21.8	3.90	3.34	43	178	29.1	21.89	52
MEAN			0.738	0.310	0.194	50	22.5	3.59	2.49	50	177	32.7	17.47	50

Table 8. Mean and standard deviations of family mean values for stool weight, stalks per stool, stalk weight, stalk diameter, and stalk height along with the number of smutted stalks per cross.

Cross	Female	Male	Stool[1] wt.	Stalks per stool	Stalk wt.	Stalk diam.	Stalk ht.	Smut whips
			kg	no.	kg	mm	cm	no.
XL90-139	LCP88-091	LCP88-091	1.57±0.33	4.60±0.11	0.341±0.072	20.1±2.85	109±19.8	
XL90-242	L88-059	LCP81-010	3.63±1.24	6.28±1.49	0.595±0.188	21.2±2.73	164±22.1	
XL90-152	L88-063	L88-063	2.86±1.98	4.93±1.57	0.561±0.302	22.6±5.36	124±25.0	
XL90-191	LCP85-376	CP78-317	3.60±1.42	5.85±1.00	0.615±0.209	20.8±2.43	177±40.0	
XL90-075	CP74-383	CP79-318	3.52±1.57	5.53±0.56	0.633±0.266	22.9±3.54	149±38.1	
XL90-042	CP78-317	CP76-331	3.82±1.44	4.98±0.79	0.776±0.306	23.0±3.00	179±30.9	
XL85-187	CP79-318	CP76-301	3.74±1.64	5.68±0.39	0.660±0.283	22.4±3.78	158±34.0	
XL90-151	LCP81-015	L88-063	3.89±1.50	5.30±0.40	0.733±0.270	22.3±3.09	181±24.3	
XL90-061	CP86-916	CP86-916	3.61±1.72	5.85±1.62	0.604±0.222	23.8±2.79	132±30.4	
XL90-089	CP78-317	LCP86-402	4.04±1.33	6.83±0.52	0.598±0.205	20.6±2.86	171±26.9	30
XL90-203	LCP85-336	CP77-407	3.61±1.84	6.65±0.58	0.533±0.242	20.4±3.41	154±36.5	
XL90-128	LCP85-336	LCP85-336	3.86±1.56	7.18±1.31	0.546±0.212	20.8±3.17	153±21.9	
XL90-150	CP78-317	CP77-310	3.57±1.93	5.65±1.22	0.602±0.228	20.3±3.17	178±21.4	
XL90-294	CP86-974	CP79-318	3.97±1.56	5.35±1.49	0.770±0.323	23.1±3.38	174±24.3	
XL90-239	LCP86-393	CP77-310	4.23±1.28	6.08±1.21	0.707±0.192	21.8±1.93	187±29.5	
XL90-043	LCP87-017	CP76-331	4.00±1.64	5.65±0.34	0.706±0.276	23.2±3.45	159±22.8	
XL90-202	CP75-361	CP75-1082	4.11±1.47	4.95±0.79	0.849±0.324	24.5±3.72	173±24.8	2
XL90-051	CP65-357	CP87-662	4.03±1.57	6.35±0.43	0.634±0.237	21.1±2.65	175±29.1	
XL90-187	LCP86-429	L78-063	4.08±1.51	6.33±1.26	0.645±0.211	21.5±3.36	175±36.9	
XL90-277	LCP86-408	LCP85-384	4.01±1.71	6.18±0.61	0.658±0.308	21.5±3.73	169±29.9	
XL90-271	CP74-383	CP73-343	4.03±1.74	5.50±0.51	0.728±0.299	24.8±3.91	145±31.5	
XL90-288	CP86-917	LCP81-030	3.73±2.07	4.88±1.09	0.741±0.346	24.1±4.25	151±33.4	
XL90-108	LCP81-015	LCP86-454	4.17±1.55	6.25±0.94	0.676±0.247	21.9±2.79	174±29.7	
XL85-220	CP80-351	LCP81-030	4.00±1.82	5.95±0.86	0.671±0.308	23.2±4.36	152±31.4	
XL90-292	CP70-321	LCP82-089	4.02±1.82	5.60±1.29	0.699±0.256	21.9±3.15	178±29.6	
XL90-326	LCP83-153	LCP81-030	3.97±1.99	5.05±0.37	0.790±0.412	24.9±5.07	153±42.1	
XL88-323	CP65-357	CP77-407	3.95±1.99	4.98±1.53	0.777±0.261	23.5±3.23	172±24.3	2
XL86-091	CP48-103	L83-194	4.11±1.92	6.00±2.01	0.697±0.295	22.0±3.21	174±29.6	
XL88-285	CP73-345	CP78-304	4.28±1.73	6.78±0.94	0.644±0.269	21.9±4.11	164±33.4	
XL88-132	CP80-328	L84-290	4.27±1.71	6.95±0.98	0.618±0.238	21.3±2.95	168±32.8	6
XL85-235	LCP81-009	LCP81-030	4.38±1.62	5.95±0.30	0.741±0.280	22.8±3.12	173±30.2	
XL90-258	CP77-407	LCP82-089	4.37±1.71	6.35±1.26	0.685±0.226	22.4±2.86	168±26.9	

Table 8. continued.

Cross	Female	Male	Stool[1] wt.	Stalks per stool	Stalk wt.	Stalk diam.	Stalk ht.	Smut whips
			kg	no.	kg	mm	cm	no.
XL85-258	CP80-323	CP73-351	4.15±2.09	6.43±1.18	0.635±0.244	21.9±3.01	161±29.2	
XL88-240	CP79-348	CP73-343	4.62±1.40	5.68±1.10	0.856±0.342	24.8±2.58	170±39.9	
XL88-144			4.34±1.97	5.40±0.32	0.808±0.374	24.5±4.28	160±32.2	
XL90-156	LCP81-015	L88-028	4.34±1.92	6.05±0.63	0.712±0.283	22.6±2.83	168±30.1	
XL88-218	CP79-332	LCP81-030	4.28±2.22	5.85±0.63	0.732±0.376	23.9±4.60	152±29.3	5
XL88-177	CP81-316	CP72-355	4.15±2.40	5.15±1.31	0.762±0.356	25.1±4.66	147±39.3	
XL90-248	CP76-331	LCP85-384	4.55±1.70	6.28±0.80	0.721±0.244	22.3±2.92	177±25.7	
XL90-184	CP76-331	CP77-310	4.08±2.60	6.93±1.31	0.589±0.416	20.3±9.25	145±34.4	
XL90-142	LCP87-023	LCP81-030	4.52±1.82	6.30±0.57	0.713±0.262	23.1±3.22	165±37.5	
XL87-219	CP77-405	LCP82-089	4.31±2.20	7.60±0.11	0.567±0.290	18.5±4.62	191±35.4	
XL90-349	LCP85-384	90P4	4.36±2.45	6.30±0.11	0.690±0.386	20.8±4.62	187±28.3	
XL90-032	LCP86-429	CP85-830	4.58±1.90	6.00±1.08	0.750±0.251	23.3±2.56	172±35.5	
XL90-218	LCP86-408	CP70-321	4.74±1.68	6.50±0.80	0.731±0.244	23.5±2.93	163±27.2	
XL88-256	CP79-332	CP76-331	4.58±2.00	6.48±1.04	0.709±0.290	23.1±3.04	161±34.9	
XL90-003	LCP87-017	CP87-667	4.76±1.64	6.63±0.78	0.713±0.233	23.1±2.21	165±34.1	
XL90-177	L88-047	90P2	4.76±1.64	6.65±0.94	0.723±0.252	22.6±3.19	173±27.8	
XL90-120	CP65-357	CP87-626	4.65±1.84	7.15±1.00	0.650±0.241	22.2±3.44	166±41.3	
XL90-263	CP76-351	CP77-310	4.82±1.53	6.28±1.32	0.783±0.254	23.7±2.34	173±27.8	
XL90-244	LCP81-030	LCP85-376	4.48±2.70	5.25±1.58	0.814±0.369	23.1±4.10	183±33.7	6
XL88-169	CP79-348	LCP81-030	4.72±1.98	6.65±0.91	0.704±0.268	22.9±3.33	166±29.5	
XL90-095	L88-072	90P1	4.67±2.08	6.60±2.00	0.736±0.281	23.8±4.32	160±34.9	
XL90-272	CP77-405	LCP85-336	4.82±1.85	6.65±0.11	0.726±0.282	22.5±3.28	176±30.7	
XL90-118	LCP86-395	L78-063	4.82±1.85	5.85±0.68	0.813±0.269	24.7±3.64	163±17.9	
XL90-273	CP74-383	LCP85-336	4.89±1.56	6.48±0.67	0.754±0.236	23.1±2.50	175±24.0	
XL90-199	CP86-933	CP86-933	4.60±2.46	6.90±0.63	0.663±0.328	22.5±3.95	156±33.1	
XL90-209	CP70-330	LCP86-402	4.74±2.33	6.08±0.37	0.785±0.393	23.9±4.12	163±32.5	
XL90-088	CP74-383	LCP87-496	4.65±2.58	6.15±1.40	0.738±0.298	22.5±3.57	178±24.0	
XL90-113	CP65-357	L88-028	4.81±1.97	6.68±0.78	0.719±0.275	21.9±2.35	185±44.3	
XL90-124	US78-026	90P1	4.71±2.31	6.68±1.59	0.696±0.284	21.5±3.85	179±25.9	
XL90-265	CP76-351	LCP86-402	4.77±2.25	5.35±0.62	0.899±0.435	26.3±4.31	155±35.2	15
XL88-357	CP72-370	LCP82-047	4.82±2.16	6.50±0.47	0.737±0.327	23.5±2.98	161±47.5	
XL90-071	CP74-383	LCP85-384	4.89±1.90	6.25±0.89	0.786±0.294	22.5±3.44	191±24.0	6

Table 8. continued.

Cross	Female	Male	Stool[1] wt.	Stalks per stool	Stalk wt.	Stalk diam.	Stalk ht.	Smut whips
			kg	no.	kg	mm	cm	no.
XL85-165	CP79-332	CP69-1052	4.69±2.59	6.40±1.03	0.737±0.396	22.9±3.97	166±46.4	5
XL86-317	CP65-357	CP83-657	4.81±2.25	6.70±0.91	0.708±0.287	22.1±2.96	176±34.1	1
XL88-058	CP80-352	CP81-332	4.74±2.73	5.73±1.07	0.794±0.392	23.4±4.23	171±49.2	
XL85-186	CP70-330	CP77-407	4.80±2.45	6.13±0.81	0.783±0.360	23.3±3.79	172±35.9	
XL90-084	CP78-317	CP85-830	4.79±2.39	5.80±1.21	0.824±0.353	23.2±3.61	185±27.4	
XL90-223	CP86-974	LCP85-384	4.96±1.81	6.30±0.77	0.782±0.252	23.1±3.01	181±21.2	2
XL90-135	LCP86-429	LCP85-384	5.04±1.59	6.60±0.53	0.767±0.251	23.6±3.15	170±14.1	4
XL90-287	L88-030	LCP81-030	4.86±2.33	6.60±0.86	0.730±0.319	22.4±4.01	177±25.4	
XL86-296	LCP82-089	86P5	4.90±2.11	7.90±1.45	0.623±0.250	21.8±2.56	160±36.6	
XL88-224	MP74-383	CP78-304	5.02±1.59	7.85±0.63	0.639±0.193	22.5±2.73	157±25.5	
XL88-078	CP74-383	LCP81-030	4.85±2.47	6.35±0.11	0.766±0.399	23.0±4.29	170±32.0	
XL90-241	LCP85-384	LCP81-010	4.95±2.17	5.70±0.11	0.867±0.375	24.1±2.74	182±44.4	
XL88-122	CP79-318	CP62-258	4.87±2.36	5.98±0.49	0.812±0.391	23.5±4.22	175±32.9	
XL90-109	LCP81-030	LCP86-454	4.89±2.23	6.38±0.83	0.775±0.341	24.7±4.17	151±33.3	
XL87-256	LCP84-215	LCP81-030	4.76±2.87	6.50±0.77	0.719±0.397	21.7±5.13	177±25.9	
XL86-255	CP61-037	CP69-1052	4.89±2.24	6.33±1.24	0.781±0.318	24.1±3.82	164±29.3	
XL90-092	CP77-407	90P1	4.74±2.96	6.10±2.82	0.768±0.313	22.2±3.93	189±23.7	
XL90-167	LCP85-336	CP76-331	4.97±2.08	6.58±1.59	0.753±0.263	24.2±3.08	158±26.5	
XL88-304	CP80-323	LCP82-047	4.95±2.03	6.80±0.90	0.726±0.285	21.6±3.60	191±38.1	
XL90-114	CP74-383	L88-028	4.88±2.74	5.70±0.53	0.840±0.436	24.3±4.44	165±39.4	
XL90-098	CP72-370	CP86-916	5.05±1.98	6.05±0.40	0.830±0.310	23.5±3.27	185±28.5	
XL85-199	L82-107	CP69-373	4.73±3.63	6.20±1.37	0.743±0.493	22.4±5.87	167±33.3	
XL88-370	CP61-037	CP67-412	4.86±2.97	6.43±1.05	0.730±0.378	22.9±4.70	164±46.0	
XL85-147	CP79-318	LCP81-030	4.85±2.78	6.73±1.16	0.705±0.341	23.0±4.41	158±35.5	
XL90-224	CP76-351	LCP85-384	4.88±2.67	7.03±1.09	0.688±0.339	20.5±4.55	194±31.4	
XL90-334	CP72-370	CP79-318	5.12±1.65	5.88±0.81	0.876±0.262	24.3±2.38	184±25.5	
XL90-082	CP78-317	LCP87-479	4.87±3.07	6.05±1.12	0.770±0.422	23.0±4.90	168±37.7	
XL90-140	CP87-649	LCP81-030	4.96±2.70	5.93±1.28	0.813±0.392	24.0±3.15	169±54.5	
XL89-358	CP72-355	CP77-310	4.96±2.56	6.30±0.90	0.778±0.363	23.7±4.55	166±39.3	
XL86-144	CP80-313	L77-038	4.95±2.62	6.45±0.69	0.748±0.344	23.7±4.06	159±22.9	
XL90-066	CP65-357	LCP87-496	5.17±1.48	6.38±0.96	0.813±0.214	23.4±1.89	185±23.5	
XL90-269	CP87-609	CP77-407	4.97±2.55	6.43±1.23	0.754±0.337	23.0±4.20	170±28.8	

Table 8. continued.

Cross	Female	Male	Stool[1] wt.	Stalks per stool	Stalk wt.	Stalk diam.	Stalk ht.	Smut whips
			kg	no.	kg	mm	cm	no.
XL90-219	LCP86-408	CP77-310	4.95±2.59	7.08±1.73	0.681±0.246	22.5±3.54	167±28.7	
XL88-080	LCP81-005	LCP81-030	5.02±2.62	6.20±0.82	0.790±0.349	23.2±3.85	177±43.7	
XL90-063	CP70-330	CP76-331	5.09±2.40	6.25±1.60	0.804±0.310	23.0±3.10	185±31.0	
XL90-302	LCP81-015	LCP86-402	5.06±2.32	6.65±0.82	0.772±0.366	23.3±4.10	170±36.1	
XL90-210	CP74-383	CP77-310	5.10±2.05	6.58±1.38	0.781±0.260	23.7±3.07	174±34.5	
XL85-251	CP48-103	CP69-1052	4.99±2.83	6.68±1.62	0.740±0.331	21.8±3.86	185±32.3	
XL90-027	LCP87-492	LCP85-384	5.00±2.62	8.38±0.81	0.590±0.287	20.8±3.00	164±43.1	
XL90-201	CP77-310	CP75-1082	5.07±2.63	6.08±1.43	0.841±0.400	24.0±4.13	174±29.7	
XL90-257	LCP81-030	LCP82-089	5.08±2.64	6.45±0.74	0.771±0.346	21.8±4.23	195±31.7	5
XL90-179	LCP86-420	LCP81-030	5.24±1.62	6.73±0.27	0.778±0.238	21.4±2.76	212±27.6	
XL90-067	CP75-361	CP87-618	5.12±2.44	6.73±0.54	0.749±0.277	22.4±3.01	183±33.4	5
XL90-318	CP70-330	CP83-644	5.12±2.49	7.03±1.00	0.712±0.297	23.1±3.69	164±34.1	2
XL90-254	CP74-383	CP75-308	5.12±2.38	7.35±1.09	0.691±0.270	21.6±3.92	183±20.1	
XL85-128			5.05±3.02	8.15±2.16	0.608±0.302	21.4±3.66	157±34.6	5
XL90-253	CP78-317	US77-010	5.21±2.08	6.68±1.02	0.784±0.285	21.4±3.19	208±23.1	
XL90-176	CP77-405	90P2	5.20±2.10	6.65±1.71	0.795±0.305	24.9±3.60	157±29.2	
XL90-293	CP74-383	LCP82-089	5.12±2.97	7.03±3.16	0.721±0.276	21.9±3.49	183±23.1	
XL90-163	LCP86-429	LCP87-496	5.15±2.53	7.35±0.39	0.694±0.328	22.9±3.63	157±40.5	
XL90-174	LCP87-023	90P2	5.21±2.48	4.98±0.91	1.062±0.487	26.3±4.33	184±40.7	
XL90-301	US86-002	LCP85-384	5.28±2.18	6.55±0.26	0.806±0.320	23.7±3.66	173±30.6	
XL90-317	CP74-383	CP83-644	5.27±2.14	6.55±0.26	0.806±0.328	22.9±3.68	189±32.8	
XL90-193	CP74-383	CP72-370	5.27±2.20	6.48±0.34	0.814±0.344	23.7±4.26	174±32.9	
XL90-039	CP65-357	CP76-331	5.24±2.47	6.39±1.50	0.823±0.332	25.5±3.63	153±26.3	
XL90-016	LCP87-492	CP76-331	5.24±2.22	7.05±1.16	0.739±0.266	24.2±2.60	154±34.5	
XL90-214	CP87-665	90P2	5.32±2.10	6.35±0.99	0.840±0.291	23.9±3.02	181±21.9	
XL90-096	LCP81-030	90P1	5.31±2.05	6.98±1.67	0.779±0.297	21.7±3.52	201±22.3	
XL90-161	LCP86-429	L88-063	5.32±1.83	6.88±0.53	0.777±0.271	23.9±2.96	167±27.6	
XL88-267	CP79-348	LCP85-384	5.28±2.44	7.20±1.85	0.746±0.306	22.4±5.19	176±19.6	
XL90-227	LCP82-089	LCP82-089	5.32±2.72	8.70±1.87	0.608±0.253	22.6±4.15	143±22.4	
XL90-243	LCP85-384	LCP85-336	5.33±2.40	7.60±0.65	0.700±0.311	21.2±4.56	188±14.0	1
XL90-282	CP80-329	CP77-310	5.38±2.31	6.33±0.95	0.835±0.298	23.9±3.47	179±29.4	
XL90-197	CP75-361	CP86-933	5.39±2.22	6.58±0.91	0.813±0.310	23.7±3.50	177±23.9	

Table 8. continued.

Cross	Female	Male	Stool[1] wt.	Stalks per stool	Stalk wt.	Stalk diam.	Stalk ht.	Smut whips
			kg	no.	kg	mm	cm	no.
XL90-341	LCP85-336	90P3	5.34±3.04	6.68±1.63	0.848±0.494	25.6±4.93	147±45.1	
XL89-228	CP73-345	CP62-258	5.35±2.12	7.03±0.94	0.757±0.277	22.5±3.34	184±29.7	
XL90-046	LCP86-496	CP77-407	5.31±3.43	7.93±1.61	0.650±0.368	21.1±4.90	170±35.9	
XL88-024	CP83-607	US77-009	5.39±1.69	7.70±1.01	0.712±0.236	22.6±3.18	174±27.9	
XL90-252	CP76-331	CP85-845	5.40±2.62	5.93±1.58	0.895±0.304	25.5±3.07	169±28.4	
XL90-164	LCP86-429	LCP86-395	5.39±3.01	6.08±1.62	0.859±0.346	25.1±2.62	167±39.9	
XL85-163	LCP82-033	CP72-355	5.45±1.99	6.58±0.99	0.827±0.272	24.4±3.76	173±27.0	
XL90-301	US86-002	LCP85-384	5.43±2.67	6.81±1.47	0.793±0.339	23.4±3.85	176±34.4	
XL90-353	LCP87-494	90P4	5.44±2.99	7.15±1.03	0.757±0.252	22.5±3.04	185±35.3	
XL90-149	CP76-351	US77-010	5.43±2.56	7.00±0.53	0.762±0.320	22.2±4.07	187±14.3	
XL86-196	CP82-559	CP80-323	5.43±3.01	7.78±2.26	0.660±0.266	22.1±3.03	165±42.4	
XL90-329	LCP85-336	90P3	5.41±2.69	7.50±1.50	0.719±0.328	20.8±3.90	199±32.3	
XL90-138	CP76-351	LCP88-091	5.49±3.06	5.45±1.46	0.975±0.400	25.4±3.93	183±30.8	
XL90-170	CP85-845	CP85-845	5.51±2.67	6.30±1.21	0.873±0.356	25.7±4.03	160±25.9	
XL86-035	CP65-357	LCP81-030	5.49±3.31	6.78±1.36	0.801±0.400	24.1±5.07	164±38.9	10
XL90-102	CP86-915	CP77-310	5.52±2.50	6.03±0.66	0.900±0.363	24.9±3.43	175±34.6	
XL90-284	LCP81-030	LCP86-393	5.51±2.01	5.78±1.00	0.971±0.362	24.6±3.96	196±21.8	
XL85-077	CP78-357	LCP81-030	5.59±3.18	6.45±0.47	0.860±0.456	22.6±4.92	201±26.2	15
XL90-162	LCP86-429	LCP86-402	5.60±3.09	6.15±1.50	0.905±0.407	25.5±4.34	166±33.5	
XL90-188	CP75-361	LCP85-384	5.63±3.30	6.50±0.90	0.847±0.414	23.3±4.49	185±30.0	17
XL90-228	CP75-361	CP85-803	5.55±2.26	6.35±1.57	0.894±0.406	23.4±5.25	195±31.2	
XL90-055	CP74-383	CP87-662	5.58±2.68	6.85±1.20	0.806±0.334	24.4±3.88	163±35.6	
XL90-040	LCP87-496	CP76-331	5.51±2.02	6.95±1.26	0.789±0.251	24.7±2.59	159±28.3	
XL88-171	US77-017	CP80-329	5.53±2.19	6.90±0.78	0.791±0.264	24.4±3.43	166±22.0	
XL88-113	LCP85-384	CP80-313	5.65±3.61	7.63±2.21	0.713±0.383	23.0±4.53	159±23.8	
XL88-238	CP79-332	CP78-357	5.52±2.50	7.55±1.37	0.719±0.248	21.6±2.82	190±21.2	6
XL90-111	CP75-361	US77-010	5.57±2.02	6.45±1.41	0.855±0.229	23.7±2.29	191±16.6	
XL90-309	CP78-357	CP80-323	5.60±2.13	6.45±1.42	0.869±0.308	23.4±3.23	195±22.9	
XL85-224	CP80-319	CP69-1052	5.62±2.68	6.80±1.05	0.809±0.345	22.6±3.47	191±38.6	8
XL90-298	CP76-331	LCP86-454	5.61±2.49	7.23±1.29	0.793±0.377	24.9±3.58	153±35.8	
XL90-127	LCP86-429	LCP85-336	5.56±1.65	7.08±0.62	0.787±0.236	23.9±1.84	173±35.3	
XL90-266	CP75-361	CP82-550	5.58±2.29	7.02±0.24	0.794±0.322	23.0±4.24	184±26.9	

Table 8. continued.

Cross	Female	Male	Stool[1] wt.	Stalks per stool	Stalk wt.	Stalk diam.	Stalk ht.	Smut whips
			kg	no.	kg	mm	cm	no.
XL90-144	CP76-351	LCP81-010	5.57±2.05	8.30±0.63	0.683±0.283	22.6±3.68	165±30.8	12
XL90-211	CP65-357	LCP81-030	5.68±2.27	6.28±0.44	0.904±0.363	24.7±3.51	179±39.3	
XL90-230	CP74-383	CP80-323	5.84±3.87	6.50±0.86	0.875±0.487	24.3±4.50	173±32.5	
XL90-079	LCP81-015	L88-075	5.70±2.60	7.13±1.87	0.809±0.344	22.4±3.46	194±32.2	
XL90-006	LCP87-017	LCP87-472	5.64±2.41	6.93±0.60	0.812±0.326	23.6±3.62	178±22.1	
XL90-090	CP75-361	LCP86-402	5.72±2.78	7.50±2.79	0.758±0.286	22.7±3.48	180±24.9	
XL90-081	CP76-351	CP87-618	5.71±2.80	7.55±2.09	0.736±0.191	22.3±1.92	186±21.6	
XL90-225	CP72-370	LCP85-384	5.68±2.51	7.98±1.39	0.715±0.288	21.8±2.66	182±40.0	2
XL90-165	LCP85-336	LCP81-030	5.66±2.56	7.94±1.02	0.707±0.302	22.9±3.74	162±26.4	
XL90-299	CP74-383	CP85-845	5.72±2.17	6.43±0.78	0.892±0.339	24.1±3.37	188±20.9	
XL90-154	CP74-383	US80-004	5.75±2.78	6.75±0.69	0.838±0.348	23.8±3.83	181±33.6	
XL90-169	LCP81-010	CP85-845	5.70±2.25	6.90±1.48	0.830±0.289	24.8±2.70	166±25.8	
XL85-149	COLDTOL	LCP81-030	5.83±2.98	7.08±1.06	0.811±0.367	24.2±4.21	164±30.2	
XL86-123	CP82-537	CP76-331	5.79±3.13	7.23±1.48	0.797±0.421	23.6±4.74	170±44.5	
XL90-276	CP77-405	LCP85-384	5.71±2.47	7.90±1.64	0.743±0.326	22.0±3.74	184±30.3	4
XL90-352	LCP85-336	90P4	5.77±3.02	8.98±2.99	0.631±0.244	20.8±2.70	177±32.5	3
XL89-408	CP73-345	CP77-407	5.82±2.97	7.63±0.20	0.764±0.396	22.7±4.02	173±37.9	
XL90-246	LCP85-384	CP75-1082	5.75±2.21	5.70±0.42	1.008±0.372	27.5±3.60	163±21.6	
XL90-182	LCP86-429	CP75-1082	5.89±3.21	5.75±0.65	1.024±0.515	25.4±4.99	185±33.1	
XL90-158	LCP81-030	LCP86-402	5.78±2.34	6.48±0.41	0.889±0.335	24.3±3.88	184±19.3	
XL90-133	CP72-370	CP72-370	5.79±2.30	6.48±0.86	0.888±0.293	25.1±2.86	174±24.7	
XL90-339	CP75-1082	90P3	5.85±2.67	6.45±1.06	0.898±0.352	24.9±3.44	175±28.9	
XL90-171	CP77-310	L88-046	6.00±3.90	7.23±2.30	0.801±0.350	23.2±3.64	179±28.4	
XL90-087	CP86-916	CP76-331	5.97±3.48	7.20±2.01	0.820±0.355	24.6±3.74	164±29.6	
XL90-134	LCP86-429	CP77-310	5.80±2.44	7.25±1.00	0.794±0.302	23.3±2.93	178±29.4	
XL85-214	CP80-352	CP76-301	5.85±2.83	7.13±0.54	0.810±0.357	22.7±4.22	190±29.2	
XL90-132	LCP86-429	CP72-370	5.92±2.66	6.25±0.45	0.948±0.431	26.7±3.87	163±39.2	
XL90-099	CP65-357	LCP86-402	5.82±2.22	6.28±0.81	0.919±0.305	24.5±3.13	189±21.2	
XL90-041	LCP86-429	CP76-331	5.75±1.96	6.73±0.95	0.874±0.333	26.2±3.33	154±30.2	
XL85-197	CP79-332	CP62-258	5.90±2.61	6.85±0.69	0.868±0.375	23.9±2.85	184±44.4	
XL90-200	CP70-330	LCP86-454	5.79±2.10	8.65±2.54	0.673±0.177	23.4±2.31	154±21.5	
XL90-160	LCP81-015	LCP85-384	5.89±2.74	8.30±1.80	0.714±0.288	21.9±3.70	180±26.7	

Table 8. continued.

Cross	Female	Male	Stool[1] wt.	Stalks per stool	Stalk wt.	Stalk diam.	Stalk ht.	Smut whips
			kg	no.	kg	mm	cm	no.
XL88-014	CP80-328	L75-056	5.88±2.52	7.68±0.54	0.760±0.304	22.3±3.80	187±34.4	
XL90-347	CP82-550	LCP82-089	6.00±2.78	7.85±1.54	0.771±0.332	22.8±4.01	180±25.7	
XL90-226	CP75-361	LCP82-089	5.79±1.88	8.40±2.11	0.705±0.195	23.4±2.81	162±16.3	
XL88-174	CP76-351	CP77-407	6.03±2.87	7.13±0.32	0.843±0.392	23.0±3.45	192±63.0	
XL90-069	LCP87-492	CP77-405	5.97±2.49	7.03±0.82	0.841±0.317	23.6±3.51	184±25.5	
XL86-178	CP82-527	CP80-323	5.95±2.32	7.05±0.64	0.836±0.291	24.3±3.03	174±26.0	
XL90-037	L88-069	CP87-662	5.95±2.31	7.28±0.73	0.828±0.326	22.6±3.75	197±23.6	4
XL90-168	CP86-974	CP72-370	5.95±2.18	6.45±0.88	0.918±0.293	25.6±3.00	173±28.8	
XL85-225	LCP82-047	CP69-1052	6.63±5.01	7.33±2.24	0.865±0.522	23.2±4.08	184±59.1	
XL90-238	US77-010	CP78-317	5.91±1.98	7.25±0.62	0.813±0.259	22.8±2.50	194±36.1	
XL90-315	CP72-370	LCP87-494	6.70±4.72	6.83±2.84	0.964±0.436	24.6±4.62	192±26.7	
XL86-128	LCP82-046	LCP81-030	6.11±2.41	6.85±1.42	0.900±0.311	24.6±2.88	184±35.3	
XL86-087	LCP81-010	CP76-331	6.27±2.91	7.13±1.29	0.875±0.357	24.4±4.51	181±36.8	
XL88-117	CP74-383	CP67-412	6.25±2.93	7.48±1.57	0.841±0.388	24.3±4.15	171±47.7	
XL90-206	CP70-330	LCP87-023	6.18±2.79	7.70±1.21	0.806±0.362	22.5±3.69	190±37.6	
XL90-107	CP65-357	LCP86-454	7.00±5.35	6.95±0.79	0.979±0.672	24.5±6.54	182±36.5	
XL90-178	CP87-638	90P2	6.04±1.94	6.93±0.36	0.876±0.286	23.2±2.52	202±38.4	
XL90-310	CP75-361	CP80-323	6.13±2.22	7.20±0.78	0.853±0.296	23.6±2.62	188±27.6	
XL88-332	CP65-357	CP80-323	6.12±2.30	7.60±1.45	0.813±0.293	24.7±3.32	165±34.1	
XL89-462	CP79-348	CP80-323	6.36±2.77	7.05±1.17	0.898±0.337	24.6±3.02	181±34.4	7
XL90-234	CP65-357	CP87-657	6.71±4.02	7.23±1.21	0.886±0.429	23.9±3.42	185±41.9	
XL90-052	CP87-625	CP77-405	7.06±4.76	7.25±0.47	0.966±0.617	24.8±6.18	182±25.1	
XL85-182	CP65-357	CP70-321	6.37±2.70	7.25±1.24	0.876±0.326	23.6±2.81	193±36.3	
XL90-351	CP77-405	90P4	6.90±4.04	8.50±1.90	0.808±0.407	23.1±4.48	181±32.2	
XL90-145	LCP86-429	LCP81-010	6.23±2.29	7.58±0.83	0.827±0.306	23.4±3.36	186±24.3	
XL90-094	CP77-405	90P1	6.36±2.61	7.75±0.72	0.823±0.343	23.0±3.51	187±38.5	
XL88-417	CP80-328	LCP83-149	6.28±2.43	7.90±0.61	0.801±0.315	23.5±3.61	175±31.7	
XL90-175	CP87-649	90P2	6.34±2.33	6.03±1.03	1.053±0.336	26.2±2.77	191±36.6	
XL90-343	US78-026	90P3	6.49±2.76	7.00±1.04	0.916±0.358	24.1±3.04	191±41.4	
XL90-259	CP76-351	L88-070	6.37±2.41	7.30±1.76	0.872±0.296	24.5±4.16	178±19.6	
XL88-379	CP78-357	LCP81-010	6.41±2.48	7.48±1.27	0.860±0.305	24.2±3.02	181±37.3	
XL90-247	L88-059	CP75-1082	6.19±1.96	7.90±1.28	0.784±0.235	23.5±2.36	177±32.2	

Table 8. continued.

Cross	Female	Male	Stool[1] wt.	Stalks per stool	Stalk wt.	Stalk diam.	Stalk ht.	Smut whips
			kg	no.	kg	mm	cm	no.
XL90-217	CP75-361	CP70-321	6.69±3.02	6.98±1.31	0.944±0.397	23.5±4.22	207±20.8	
XL90-328	CP75-361	90P3	6.41±2.36	7.15±0.58	0.894±0.294	23.6±3.00	198±23.0	
XL86-085	LCP81-010	CP72-355	6.57±2.86	7.50±0.72	0.860±0.335	23.0±3.73	198±23.5	
XL90-240	CP77-405	CP73-343	6.18±1.89	7.45±0.64	0.837±0.269	24.3±3.18	175±16.8	
XL90-186	LCP86-420	L78-063	6.31±2.18	7.38±0.26	0.855±0.293	23.6±3.18	189±28.1	
XL90-050	CP65-357	CP85-830	6.39±2.18	6.45±0.92	0.994±0.312	25.4±3.25	191±20.6	
XL90-116	CP65-357	CP82-550	6.92±3.32	7.23±0.96	0.951±0.404	25.0±3.90	184±38.6	
XL90-268	CP83-644	CP77-310	6.77±3.13	7.70±1.96	0.875±0.337	23.7±3.54	189±27.8	
XL90-307	CP85-803	CP77-407	6.70±2.69	7.68±1.10	0.868±0.308	25.1±3.46	170±15.7	
XL87-063	CP79-318	US77-010	6.83±2.88	7.30±1.18	0.956±0.433	26.0±4.77	172±34.3	
XL85-254	CP79-318	CP69-1052	6.74±2.67	7.43±1.18	0.922±0.391	24.9±4.15	180±29.6	
XL90-207	CP75-361	LCP87-023	6.95±3.05	7.35±0.88	0.933±0.374	23.1±3.60	214±24.2	
XL88-064	LCP85-313	LCP85-336	6.78±2.75	9.65±1.00	0.694±0.249	21.0±2.70	193±31.4	
XL90-261	CP74-383	LCP85-376	7.90±4.86	8.25±0.47	0.967±0.620	25.2±5.94	177±33.0	
XL90-190	LCP86-429	CP78-317	6.70±2.48	6.95±1.00	0.967±0.342	24.7±3.31	195±28.4	
XL90-044	CP65-357	LCP85-384	6.49±2.03	6.95±0.33	0.934±0.289	23.2±2.84	216±17.7	2
XL90-125	LCP86-429	CP77-405	7.99±4.82	7.70±2.21	1.005±0.407	26.1±3.47	179±27.7	
XL90-141	LCP86-429	LCP81-030	7.06±3.13	7.35±0.98	0.958±0.397	24.5±3.46	193±36.0	
XL90-192	LCP81-030	CP72-370	6.60±2.27	7.53±0.31	0.879±0.298	24.4±3.29	182±22.9	
XL90-340	LCP81-030	90P3	6.74±2.41	6.45±0.60	1.067±0.425	26.7±3.51	181±38.4	
XL90-033	L88-060	LCP87-472	7.04±2.92	8.58±0.47	0.820±0.329	23.6±3.39	178±25.8	
XL89-223	LCP81-005	CP62-258	7.14±2.94	7.75±1.39	0.931±0.381	24.4±4.28	191±21.3	
XL90-010	LCP87-017	US78-026	6.74±2.31	7.50±0.92	0.906±0.303	22.4±3.02	222±30.3	13
XL85-176	CP78-357	LCP81-030	6.78±2.38	8.38±0.87	0.811±0.292	22.5±3.10	200±47.6	
XL90-280	CP72-370	LCP86-393	7.09±2.72	7.15±0.81	1.001±0.400	24.4±3.87	203±25.0	12
XL90-198	CP65-357	CP86-933	6.95±2.47	7.53±0.53	0.924±0.318	24.5±3.45	187±28.2	
XL88-114	LCP85-384	CP80-329	7.38±3.16	9.05±1.54	0.812±0.316	23.5±3.83	179±25.0	
XL85-218	CP80-328	CP70-321	7.89±3.91	8.08±0.75	0.971±0.471	24.2±4.95	194±30.9	
XL90-308	LCP86-408	CP80-323	6.34±1.35	7.90±0.95	0.821±0.228	23.8±3.48	181±9.8	
XL90-330	CP76-331	90P3	7.69±3.24	7.73±0.96	1.006±0.435	24.6±3.96	201±37.6	
XL90-196	CP65-357	L88-063	8.51±4.10	8.25±1.81	1.016±0.377	24.8±3.78	202±21.3	
XL88-196	CP83-644	CP57-614	7.61±2.87	8.75±1.92	0.893±0.343	24.5±3.48	181±25.0	

Table 8. continued.

Cross	Female	Male	Stool[1] wt.	Stalks per stool	Stalk wt.	Stalk diam.	Stalk ht.	Smut whips
			kg	no.	kg	mm	cm	no.
XL90-093	L78-063	90P1	9.30±5.04	8.55±1.08	1.068±0.508	24.5±5.57	209±31.6	
XL90-290	CP77-405	CP85-803	8.96±3.96	9.08±2.73	1.002±0.370	26.5±3.20	174±30.0	
XL88-056	US77-017	CP72-356	9.71±4.25	10.20±2.01	0.973±0.428	24.7±4.61	194±49.4	
MEAN			5.43±2.44	6.81±1.07	0.794±0.324	23.4±3.62	176±30.7	

1 mean ± standard deviation of family mean (row mean) value.

Table 9. First ratoon mean and standard deviations for mean family row value for stalks per stool and smut whips for 50 crosses grown at the Ardoyne Farm in 1992.

Cross	Female	Male	Stalks per stool	Smut whips
HB85-3057	CP76-331	CP72-355	9.29 ± 1.63	71
HB85-3125	CP67-412	CP76-331	9.37 ± 0.79	
HB85-3054	CP76-331	CP67-412	10.26 ± 2.67	
HB86-3161A	CP79-348	CP79-348	9.34 ± 0.59	4
HB86-3190	CP82-527	CP78-304	9.94 ± 1.05	
HB88-3008	CP74-383	LCP81-10	9.12 ± 0.25	
HB88-3012	CP74-383	CP82-519	12.72 ± 1.60	
H85-648	CP82-547	CP72-2086	8.92 ± 0.80	
H86-416	CP74-383	CP72-2086	7.77 ± 1.30	
H86-610	CP74-383	CP83-632	8.58 ± 0.34	
H86-74	LCP81-10	LCP81-30	8.54 ± 1.26	
H87-34	CP81-1425	CP76-331	9.33 ± 1.44	
H87-554	CP74-383	CP70-321	8.59 ± 0.56	
H87-697	CP72-1210	LCP81-30	7.50 ± 0.85	
H87-120	CP74-383	CP81-1435	7.80 ± 0.97	
H88-449	CP85-834	CP83-632	11.2 ± 1.09	
H88-452	CP85-806	CP83-632	10.1 ± 1.09	6
H88-503	CP65-357	CP84-734	8.83 ± 1.03	6
H88-510	CP84-722	L83-193	9.12 ± 1.23	
H88-583	LCP83-165	CP74-383	8.54 ± 0.57	
H88-739	CP72-370	CP83-632	8.37 ± 0.91	
H88-755	CP82-547	CP65-357	8.19 ± 1.47	

Table 9. continued.

Cross	Female	Male	Stalks per stool	Smut whips
H88-76	CP85-845	CP85-830	9.01 ± 0.32	
H88-120	CP85-800	CP85-830	10.12 ± 0.69	8
H88-935	CP85-806	CP83-657	9.75 ± 1.23	
H88-936	CP76-331	CP83-657	8.55 ± 1.02	14
H89-1003	LCP85-384	LCP81-30	10.16 ± 1.03	
H89-346	CP85-861	CP85-830	9.62 ± 1.16	
H89-367	CP65-357	CP85-834	9.38 ± 1.05	36
H89-757	CP65-357	CP85-845	8.83 ± 1.07	
H89-857	CP84-755	CP80-356	6.76 ± 0.39	16
H89-858	CP86-915	CP80-356	8.53 ± 0.84	
H89-873	CP86-917	LCP82-89	8.89 ± 0.96	
H89-855	CP84-734	CP80-356	8.26 ± 0.70	
H89-966	CP83-606	CP85-811	8.87 ± 2.34	
H90-172	CP87-625	CP85-803	9.52 ± 1.30	9
H90-177	CP84-726	CP76-331	9.24 ± 0.93	
H90-230	LCP86-426	LCP84-222	8.58 ± 0.85	
H90-232	LCP86-457	LCP84-222	10.23 ± 0.80	
H90-255	CP87-619	CP85-834	9.68 ± 0.88	
H90-261	CP87-626	CP85-834	10.1 ± 0.80	
H90-356	CP85-857	CP76-331	9.42 ± 0.99	
H90-359	CP85-830	LCP86-454	8.33 ± 0.32	
H90-389	CP85-845	CP86-972	8.51 ± 0.25	
H90-534	CP76-331	LCP86-402	8.47 ± 1.16	6
H90-546	LCP84-222	LCP86-402	9.49 ± 0.48	
H90-626	CP87-644	CP85-811	9.09 ± 0.77	
H90-649	CP85-857	CP87-657	8.58 ± 0.48	
H90-723	CP76-331	CP85-834	9.34 ± 1.09	
H90-93	CP85-829	CP84-726	10.94 ± 0.58	30

Table 10. Man-hours to collect mean row data on stalk number, stool number, stalk height, and stalk diameter for 256 crosses.

	Stalk Number		Stool Number		Stalk Height		Stalk Diameter	
Block	1	2	1	2	1	2	1	2
Men	2	2	1	1	2	1	3	2
Hours	1.5	1.7	2.0	2.0	5.0	6.5	4.5	5.0
Total	3.0	3.4	2.0	2.0	10.0	6.5	13.5	10.0

Table 11. Man-hours to collect individual stool data on stalks per stool, stalk height, and stalk diameter on the 25 randomly selected families.

	Stalks per stool		Stalk Height		Stalk Diameter	
Block	1	2	1	2	1	2
Men	1	1	2	2	2	2
Hours	1.4	2.4*	1.5	5.0*	2.8	4.6*
Total	1.4	2.4*	3.0	10.0*	5.6	9.2*

* Data collected after Hurricane Andrew.

SUCROSE LABORATORY AT ST. GABRIEL

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The program used to capture and transmit pol and brix data to computer files for calculation of sucrose, purity, and theoretical recoverable sugar (TRS) was modified to accept plot identification via a bar code reader. Standard laboratory procedures and the ABC Clarifier were used to measure the sucrose content of the juice.

Over 2,500 samples were processed at the St. Gabriel Sucrose Laboratory during the 1992 harvest season (Table 1). The juice was extracted via a three roller mill for most of the samples (2,451). The freeze of November 28th and 29th resulted in deterioration of the upper portions of the stalks in some trials. The result was unclarifiable juice in the worst cases. In consultation with the project leader(s), the upper 25% of the stalks was not used for analysis in these trials. One hundred twelve samples were analyzed for fiber via chip/press extraction.

Table 1. Number of sugarcane samples processed at the St. Gabriel Sucrose Laboratory during the 1992 harvest season.

PROJECT	NUMBER OF SAMPLES
Cultural Practices and Fertility	
Ricaud	676
Hallmark	236
Viator	57
Cochran	8
Entomology	44
Weed Science	75
Variety Development	
Infield	310
Line Trial	652
Nursery	393
Nursery (fiber)	112
TOTAL	2,563

INSECTICIDE MANAGEMENT OF THE SUGARCANE BORER AND YELLOW SUGARCANE APHID

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Insecticides were applied by air plane to first ratoon 'CP 74-383' at Palo Alto Plantation, Donaldsonville,Louisiana, for season long control of the sugarcane borer (SCB). Experimental plots averaged 2.6 acres and were arranged in a randomized block design with 4 replications. Each treatment was applied in water using an Ag Cat with 48 ft (8 rows) swaths and delivering 2.0 gallons of finished product per acre. Weekly infestation counts were taken in all plots starting the first week of June. The first application was made when 60% of the stalks showed visible internodes, and the infestation was greater than 5% of the stalks containing live larvae present in the leaf sheaths (the Louisiana Ag Center recommended threshold). The first treatment was applied on 28 July; the second on 16 August, when SCB infestation in the Asana XL treatment exceeded the economic threshold. SCB damage was assessed by counting the number of bored internodes, exit holes, and total internodes from 75 stalks (15 plants at 5 locations) in each plot (Oct 9). Yellow sugarcane aphid (YSA) infestations were monitored by counting the number of aphids on 20 randomly selected leaves positioned 3 or 4 below the whorl. The data was statistically analyzed using Analysis of Variance and means separation by LSD (0.05) tests.

Table 1 shows the 3 day live/dead mortality counts where all treatments, except for the 2nd application of Asana, provided good initial kill of the sugarcane borer. This reduced (or delayed) mortality of SCB in Asana treated plots is attributed to a lack of moisture during or immediately after the period of application.

The SCB infestation in this test (See Table 2) was moderate causing 30.5% bored internodes in untreated check plots. All of the insecticide treatments demonstrated a significant reduction of SCB and emergent moths compared to that in the untreated plots ($P < 0.05$). Asana, Guthion + Baythroid, and the two separate azinphosmethyl treatments were superior to the other treatments in this test($P < 0.05$). The Orthene treatment provided only minimal control of SCB with damage exceeding the industry economic injury level of 10% bored internodes.

The Asana treatment showed higher aphid infestations after the first application. The two azinphosmethyl and the Orthene treatments showed considerable aphid reduction for season long control.

Table 1. Percent Kill of the SCB 3 Days Post Application, Palo Alto Plantation, Donaldsonville, 1992.

Treatments lb (ai)/acre	Application Dates 28 July	16 August	Season Average
Asana XL .033	86.0	67.2*	76.6
Guthion .75	95.6	93.7	94.7
Untreated	4.8*	11.5*	8.2
Orthene .75	97.8	90.3	94.1
Sniper .75	100.0	83.3	91.7
Guth/Bayth .38/.016	87.0	91.9	89.5

* $P < 0.05$; based on search for 15 - 20 live and dead 1st - 3rd SCB larvae in leaf sheaths of each plot.

Table 2. Percent sugarcane borer infestation, internodes bored, adult production, and yield of sugar in borer/aphid management study. Four replications, Palo Alto Plantation, Donaldsonville, 1992.

Treatment	Rate lb(AI)/ac	Percent Internodes bored	% SCB control[1]	Moth Emergence (x 10^3/Acre)[2]	% Moth reduction[3]	Avg. YSA/ leaf[4]	Sugar lb/ac
Asana XL 0.66	0.033	5.9a	80.7	3.4a	83.7	2.6a	5103abc
Guthion 2 L + Baythroid 2 EC	0.38 + 0.016	6.0a	80.3	3.4a	83.7	0.8ab	6039a
Guthion 2 L	0.75	7.1a	76.7	3.3a	84.1	0.1b	5753ab
Sniper 2 L	0.75	10.0a	67.2	5.5a	73.6	0.0b	5504abc
Orthene 75 S	0.75	19.9b	34.8	9.9a	52.6	0.0b	4831 bc
Check	---	30.5c	----	20.9b	----	0.3b	4502 c
P>F (Anova)		0.0001		0.002			0.04
LSD (0.05)		8.7		8.4			2806

Means followed by same letter do not significantly differ (P = 0.05,LSD).
[1] Based on mean % internodes bored in treated vs. untreated plots.
[2] Based on a plant population of 30,000 stalks per acre.
[3] Based on SCB Moth emergence in treated vs. untreated plots.
[4] Based on sampling date of August 25th (20 leaves/plot,4 replication=80 leaves/treatment).

ASSESSMENT OF VARIETAL RESISTANCE TO THE SUGARCANE BORER

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Resistance to Diatraea saccharalis (F) damage (SCB) in sugarcane can be categorized predominately as antibiosis. Physical characteristics of the plant, such as leaf-sheath appression and rapid rind hardness development contribute to the differential survival of young larvae among cultivars. The use of percent bored internodes is a means of ranking sugarcane cultivars on observed external evidence of D. saccharalis tunneling into the stalk. However, the degree of internal damage to the plant and the ultimate survival of D. saccharalis larvae are not addressed with this assessment. Due to the impact on pest population dynamics, varietal resistance to the latter stages of D. saccharalis injury is a primary goal of the entomology contribution to the LAES breeding program.

The L90 series (39 cultivars) was planted on October 23,1991 in a four-replicated lattice design on the Lannaux Plantation, Killona, LA. Eight plots of each of the following commercially grown varieties (CP 70-321, CP65-357, CP74-383, and CP79-318) were planted in this test to be used as standards for comparison to the L90 cultivars. On October 15, 1992 a 15 stalk sample was cut from each replicate (4 replications = 60 stalks per cultivar). Each sugarcane stalk was examined to determine the number of bored internodes, moth emergence, and the total number of internodes. In this test no insecticides were used for control of the SCB, however granular Orthene was applied in late July to suppress the fire ants and enhance SCB infestation.

The overall sugarcane borer infestation was considerably less than in the 1991 test (1989 cultivars). The highest recorded SCB infestation was 41.92% bored internodes in the L90-200 cultivar, which received a rating of 9, highest in susceptibility. Only one cultivar, L90-190 received a rating of 3, comparable to that of CP70-321. These ratings are developed as an additional index in an effort to have a balanced consideration of % bored internodes and relative survival, and are always used for comparison to the standard varieties. Twenty-two L90 cultivars were dropped from the breeding program prior to this data collection.

Relative to this insect pest in sugarcane, a growers primary objective is to minimize economic impact. There are two approaches to reduce the economic impact of pests. The first is to minimize the overall cost incurred in controlling the pest. Use of resistant varieties reduces pest damage at little or no cost to the grower. Resistance rating schemes traditionally have focused on the prevention of damage, whereas our research now provides an additional criteria. Incorporating the cultivars pest survival rating allows us to flag varieties which enhance D. saccharalis populations; involves little additional data collection; and enhances the efficiency and value of the entomological component in sugarcane breeding and varietal development of the LSU Agricultural Center.

Table 1. Diatraea saccharalis damage and relative survival inside the stalk in four commercial and 17 experimental cultivars (1990 L series) during 1992 on the Lannaux Plantation, Killona, LA

Variety	% Bored Internodes	Relative Survival*	Moth Emergence (No./Acre)	Estimated Rating
CP65-357	26.57	19.70	15,800	5
CP70-321	20.49	14.86	11,000	3
CP74-383	38.99	18.59	20,200	7
CP79-318	31.13	24.59	24,400	7
L90-170	40.15	18.63	16,400	7
L90-171	26.07	14.51	12,400	4
L90-176	32.24	19.87	16,800	6
L90-178	34.02	15.29	15,600	6
L90-181	30.17	26.44	26,400	7
L90-188	27.99	16.31	14,000	5
L90-190	27.27	11.20	10,400	3
L90-191	30.52	17.56	16,800	6
L90-194	27.51	23.41	22,800	6
LCP90-198	40.30	16.37	16,800	7
L90-200	41.92	27.00	41,600	9
L90-204	21.75	16.39	11,200	4
L90-207	33.03	23.24	15,600	6
L90-208	33.48	16.01	17,600	6
L90-216	35.20	11.96	13,600	6
L90-218	32.93	17.07	14,400	6
L90-223	29.29	10.24	10,400	4

* Relative survival = 100 X no. exit-holes / no. bored internodes

References:

Bessin, R.T., T.E. Reagan, and F.A. Martin 1990, A moth production index for evaluating sugarcane cultivars for resistance to the sugarcane borer (Lepidoptera:Pyralidae). J. Economic Entomology 83 (1):221-225.

Bessin, R.T., R.E. Stinner, and T.E. Reagan. 1991. Modeling the area wide impact of sugarcane varieties and predation of sugarcane borer populations in Southern Louisiana. Environmental Entomology 20:252-7.

Bessin, R.T., E.B. Moser, T.E. Reagan, and W.H. White. 1990. Analysis of percent bored internode data collected from sugarcane varietal resistance evaluations. J. Amer. Soc. Sugar Cane Technologist 9:8-22.

INSECTICIDAL CONTROL OF THE SUGARCANE BORER
SMALL-PLOT TEST

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Season long control for the sugarcane borer (SCB) was tested in a small plot experiment located on the St.Gabriel Research Station. Thirteen insecticide treatments were evaluated in a field of first ratoon variety 'CP 74-383' using a randomized complete block experimental design with 5 replications and each plot consisting of 3 rows (6 ft centers), 24 ft in length equivalent to 0.01 acre per plot. Insecticidal applications were initiated when SCB infestations exceeded the economic threshold level of 5% of the stalks containing live larvae in the leaf sheaths. Spray treatments were applied to the sugarcane canopy of all rows in each plot with a Solo knapsack sprayer (pressure and output ca. 1.41 kg/cm^2 and 250 liters/ha, respectively); similarly, the two granular treatments were applied using a 400ml shaker jar calibrated to deliver the designated amount to the canopy (Aug 5, Sept 3, and Sept 23). Granular Orthene was applied to the test to aid in the suppression of predatory ants. SCB damage was assessed by counting the number of bored internodes, exit holes, and total internodes from 100 randomly-selected stalks (5 replications, 20 stalks/rep) of sugarcane in each treatment (Nov 6).

As shown in the table, all treatments reduced SCB infestation compared to that of the untreated check ($P < 0.05$). Except for the treatments containing either Penncap M (encapsulated methyl parathion) or Pounce (permethrin), a control of less than 10% bored internodes (industry accepted economic injury level) was achieved.

Insecticidal management of the sugarcane borer at the St. Gabriel Research Station, 1992.

Treatment	Rate lb/(AI)ac	% Internodes bored[1]	% SCB control[2]	Moth Emergence (x 10^3/acre)[3]
Baythroid 2 E +	0.016 +			
Guthion 2 L	0.38	3.7a	89.8	1.5a
Ammo 2.5 EC	0.08	4.6a	87.3	1.5a
Orthene 75S	0.75	4.9a	86.5	1.3a
Asana XL .66	0.033	5.5a	84.8	1.8a
Orthene 75S	1.0	5.6a	84.5	1.0a
Baythroid 2 EC	0.033	5.7a	84.3	4.5abc
Asana XL .66 +	0.020 +			
Orthene 75S	0.14	5.8a	84.0	2.5ab
Guthion 2 L	0.75	6.0a	83.5	1.5a
Ammo 2.5 EC	0.06	7.3ab	79.9	2.5ab
Penncap M Sp 2 F	0.75	14.9 bc	59.0	6.8 bcd
Pounce 1.5 G	0.20	15.3 bc	57.9	4.3abc
Penncap M 2 F	0.75	15.7 c	56.7	9.8 c
Pounce 1.5 G	0.15	18.2 c	49.9	8.8 bc
Check	----	36.3 d	----	19.0 d
P>F (ANOVA)		0.0001		0.0001
LSD (0.05)		8.2		6.4

Means followed by same letter do not significantly differ (P = 0.05,LSD).
[1] Based on differences in treated vs. untreated plots.
[2] Based on mean % internodes bored in treated vs. untreated plots.
[3] Based on a plant population of 25,000 stalks per acre.

STALK ROT, MOSAIC, PYTHIUM ROOT ROT, AND SMUT RESEARCH

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Stalk Rot Research:

The inheritance of resistance to red rot, caused by Colletotrichum falcatum, was studied in 40 crosses using 27 parents in the breeding program with variable levels of resistance. Ten progeny from each cross and the parents were inoculated and stalk rot development was assessed for each. Mid-parent-offspring regression will be used to determine the heritability of resistance. The experiment will be repeated during 1993 to determine the repeatability of clone resistance reactions.

The effects of anerobic conditions (waterlogging) and drought stress on red rot severity was studied in experiments conducted under controlled conditions. It appears that oxygen deficit stress imposed on stalks does not predispose them to severe disease development. It may be that stress due to excess water predisposes stalks to severe red rot indirectly by affecting the root system. Rot severity was increased in drought stressed CP 70-321, CP 72-370, and LCP 82-89 but not in CP 65-357 and LCP 82-89. However, it was difficult to distinguish between the effects of the stress and those caused by the disease. Field experiments were planted and are now being monitored to gain a better understanding of when and how environmental stresses predispose varieties to severe red rot.

Red rot severity following stalk inoculation was compared in field run and Kleentek cane of CP 65-357, CP 70-321, CP 72-370, CP 74-383, and LCP 82-89. Disease severity was similar between treatments for all five varieties.

Spring stands were compared for billet vs. whole stalk plantings of five varieties. Stands of CP 72-370 and CP 82-89 were not different between treatments. Stands of CP 65-357 and CP 7-321 were significantly higher in the billet treatment, and stands of CP 74-383 were lower in the billet treatment. The experiment was replanted substituting LCP 85-384 for CP 74-383, and results will be determined during Spring, 1993.

Twelve varieties and experimental varieties were inoculated and evaluated for resistance to pineapple disease, caused by Ceratocystis paradoxa. Nine varieties (75%) were highly susceptible, two were moderately susceptible, and only one was resistant to the disease. Pineapple disease is thought to be less widely distributed than red rot, but it was detected in two plant cane fields with weak stands during Spring, 1992. The parent population for the breeding program will be screened for resistance during 1993.

Mosaic Research:

The increase of mosaic, caused by sugarcane mosaic virus, was monitored with U.S. Sugarcane Research Unit personnel in five fields at four locations during the 1991-1992 season in plantings of Kleentek CP 65-357. A seasonal pattern of disease increase was evident. Mosaic infection levels increased during the fall and early winter. Disease increase was then slow until May-June when infection levels increased sharply. Final infection levels at different locations were 34, 54, 64, 72,and 80%.

The seasonal pattern of disease increase was different from the one observed during 1990-1991. Rainfall and temperature data are being compared to explain differences in patterns between seasons. Weed community makeup and the spatial pattern of disease within fields are being compared to attempt to explain differences in rates of disease increase between different locations within seasons.

Naturally occurring mosaic infection levels were monitored in varieties and experimental varieties planted in yield trials on commercial farms (outfield tests) to evaluate levels of resistance to infection by the virus. The results from counts taken from LSU and U.S. Sugarcane Research Unit tests are combined and shown in Table 1. Commercial varieties showing susceptibility were CP 65-357 and CP 72-370. One experimental variety, CP 87-626, showed moderate infection levels.

Table 1. Sugarcane mosaic virus infection levels and resistance ratings in commercial and experimental varieties determined from yield trials on commercial farms (outfield tests).

Variety	Percent infection	Rating[a]	Experimental variety	Percent infection	Rating[a]
CP 65-357	68.5	7	LCP 85-376	0.1	1
CP 70-321	3.9	1	LCP 85-384	0.1	1
CP 72-370	43.6	5	CP 85-845	2.3	1
CP 74-383	9.8	1	LCP 86-454	16.6	2
CP 79-318	4.0	1	CP 86-979	4.1	1
LCP 82-089	7.9	1	LCP 87-017	3.4	1
LHo 83-153	0.1	1	LCP 87-491	0.3	1
			CP 87-626	35.2	4
			CP 87-652	1.0	1
			CP 87-658	12.1	2
			CP 87-663	0.3	1

[a]Resistance ratings assigned on a 1-9 scale in which 1-3 = resistant, 4-6 = moderately susceptible, and 7-9 = highly susceptible.

Pythium Root Rot Research:

A preliminary experiment was conducted in the greenhouse to determine the effect of soil amendments with municipal waste compost on Pythium root rot. In a pathogenicity test with plants grown in sterile soil infested with Pythium arrhenomanes, plants of CP 70-321 grown in soil amended with compost showed decreased root rot and increased lateral root development and numbers of shoots. However, plant growth in nonsterile field soil amended with compost was not affected.

Differences in morphology and in the DNA region containing the genes coding for ribosomal subunits (rDNA) were compared for a diverse collection of P. arrhenomanes and P. graminicola. Morphology was variable, particularly for P. arrhenomanes (the sugarcane root rot pathogen), and distinguishing some isolates of the two species was difficult. However, the two species were distinguished by differences in rDNA.

Smut Research:

Resistance levels to smut were determined in an inoculated test for all experimental varieties in the variety selection program. The results are shown in Table 2. Five (62%), two (25%), and one (12%) of eight 1985-1987 series experimental varieties were resistant, moderately susceptible, or highly susceptible, respectively, to smut. Nine (90%) and one (10%) of 10 1988 series clones were resistant and moderately susceptible, respectively. Of 43 1989 series clones, 31 (72%), seven (16%), and five (12%) were resistant, moderately susceptible, or highly susceptible, and for 30 1990 series clones, 11 (37%), 10 (33%), and nine (30%) were resistant, moderately susceptible, or highly susceptible, respectively.

Table 2. Smut infection levels and resistance ratings determined from inoculated test conducted during 1992.

Variety	Percent infection	Rating[a]	Variety	Percent infection	Rating[a]
CP 65-357	47.9	7	L 89-098	38.2	6
CP 70-321	0.0	1	LHO 89-106	0.0	1
CP 73-351	79.8	9	L 89-107	47.5	7
CP 74-383	71.7	9	L 89-110	0.0	1
CP 81-335	74.0	9	L 89-113	8.1	3
LHo 83-153	7.1	3	L 89-115	0.0	1
LCP 85-384	1.8	2	L 89-116	6.5	3
CP 85-845	0.0	1	L 89-118	1.8	2
LCP 86-454	0.0	1	L 89-120	63.8	9
LCP 87-017	21.5	5	L 89-124	0.0	1
LCP 87-491	0.0	1	L 89-125	91.9	9
CP 87-626	56.1	8	LHO 89-128	0.0	1
CP 87-652	9.1	3	L 89-137	10.6	4
CP 87-658	20.4	5	L 89-148	0.0	1
L 88-046	0.0	1	L 89-152	1.4	2
L 88-063	0.0	1	L 89-163	29.9	5
LCP 88-091	0.0	1	CP 89-800	1.5	2
CP 88-702	0.0	1	CP 89-805	0.0	1
CP 88-718	2.1	2	CP 89-811	0.0	1
CP 88-739	0.0	1	CP 89-816	6.3	3
CP 88-749	10.4	4	CP 89-821	1.1	2
CP 88-755	2.7	2	CP 89-825	7.7	3
CP 88-764	0.0	1	CP 89-829	2.4	2
CP 88-769	0.0	1	CP 89-830	6.7	3
L 89-097	13.0	4	CP 89-831	32.8	6

Table 2. continued.

Variety	Percent infection	Rating[a]	Variety	Percent infection	Rating[a]
CP 89-834	6.3	3	L 90-178	13.5	4
CP 89-839	2.3	2	L 90-181	0.0	1
CP 89-843	4.8	2	L 90-187	23.6	5
CP 89-845	26.9	5	L 90-188	2.0	2
CP 89-846	51.1	8	L 90-190	8.2	3
CP 89-848	8.1	3	L 90-191	2.0	2
CP 89-853	0.0	1	L 90-194	78.8	9
CP 89-855	2.6	2	L 90-196	6.5	3
CP 89-859	0.0	1	LHO90-198	0.0	1
CP 89-864	8.4	3	L 90-200	1.0	2
CP 89-871	9.2	3	L 90-204	36.7	6
CP 89-879	5.1	3	L 90-207	32.5	6
CP 89-884	32.7	6	L 90-208	44.9	7
CP 89-885	1.5	2	L 90-210	11.6	4
CP 89-888	47.7	7	L 90-211	38.4	6
CP 89-889	4.9	2	L 90-212	44.9	7
CP 89-891	0.0	1	L 90-216	4.7	2
L 90-165	12.7	4	L 90-218	73.4	9
L 90-169	18.4	4	L 90-223	0.6	2
L 90-170	61.4	9	L 90-224	9.1	3
L 90-171	1.2	2	L 90-225	52.3	8
L 90-173	55.0	8	L 90-227	48.8	7
L 90-175	61.6	9	L 90-228	13.0	4
L 90-176	22.3	5			

[a]Resistance ratings assigned on a 1-9 scale in which 1-3 = resistant, 4-6 = moderately susceptible, and 7-9 = highly susceptible.

WEED CONTROL RESEARCH IN SUGARCANE

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In 1992, weed control research conducted in sugarcane included the evaluation of experimental and labeled herbicides for sugarcane tolerance and for control of weeds common in sugarcane fields. Diuron (Karmex/Direx) was evaluated for postemergence control of itchgrass and residual control of broadleaf weeds when applied alone and in combination with Prowl. Sugarcane cultivar sensitivity to Asulox and johnsongrass control as influenced by time of rainfall after herbicide application and fertilization were also investigated. Below is a brief summary of research results. The project personnel are appreciative of the support received from the American Sugarcane League and to the growers who allowed us to conduct some of this research on their farms.

Evaluation of Preemergence Herbicides for Itchgrass and Seedling Johnsongrass Control:

In itchgrass control studies, herbicide treatments were applied to a 36 inch band on the top of the row using a standard 3 nozzle per row arrangement. A rolling cultivator was used (2 passes) to destroy emerged itchgrass and rows were off-barred. Itchgrass control with Prowl plus atrazine 8 weeks after treatment was 91% and atrazine alone controlled 32% itchgrass. The addition of atrazine to MON 13200 (an experimental for Monsanto Company) did not increase itchgrass control over that for MON 13200 alone. MON 13200 at 1.0 lb/A plus atrazine controlled 91% itchgrass, which was greater than when applied at 0.25 lb/A. Control with Command, Command in combination with F6285, and Prodiamine provided itchgrass control similar to Prowl. F6285 applied alone controlled no more than 78% itchgrass.

In johnsongrass control studies, herbicide treatments were applied to a 36 inch band on the top of the row using a standard 3 nozzle per row arrangement. The residue on top of the row was removed with a rotary mower and rows were off-barred prior to herbicide application. Seedling johnsongrass control 61 days after treatment was at least 89% for MON 13200 at 0.25 to 1.0 lb/A, which was comparable with the standard Sencor and Sinbar treatments. The addition of atrazine to MON 13200 did not increase johnsongrass control. No visual sugarcane injury was noted with any of the treatments.

MON 13200 Studies:

To evaluate residual weed control, MON 13200 was applied PRE to a fallow area with a natural itchgrass infestation. At 20 days after treatment, when compared with an atrazine standard, MON 13200 applied at 0.50 and 1.0 lb/A reduced itchgrass emergence by 63 and 91%, respectively. At 60 days after treatment, however, itchgrass emergence was reduced compared with atrazine no more than 61%. In comparison, reductions of 49% were noted for pendimethalin (3.0 lb/A PRE) and 89% for trifluralin (2.0 lb/A PPI).

In a tolerance study, 'CP 70-321' sugarcane injury 28 days after application of MON 13200 (1.0 lb/A) to cane 33 to 45 inches in height was minimal. Late-season sugarcane stalk counts, which are indicative of yield potential, were equal to the untreated check. Studies are underway to evaluate weed control and crop response with fall and spring sequential applications.

Postemergence Control of Itchgrass at Time of Spring Herbicide Application:

Prowl was tank mixed with the Karmex at 1.6, 2.4, and 3.2 lb/A to evaluate control of emerged itchgrass as well as residual control. At time of application, itchgrass was 1 to 3 inches in height. Itchgrass control 28 days after treatment was 89 and 93% for Karmex applied at 2.4 and 3.2 lb/A, respectively. Oust, which was also evaluated, controlled itchgrass no more than 45%. Sugarcane injury was minimal with Karmex but ranged from 40 to 50% with the Oust treatments. Prowl tank-mixed with Karmex plus Agridex gave good control of emerged itchgrass which would be important particularly when application is delayed in spring. This tank-mixture would also be effective on later emerging itchgrass as well as broadleaf weeds.

Cultivar Sensitivity to Time of Asulox Application:

Sugarcane visual injury 30 days following the June 15 Asulox application was 25% for CP 72-370 and 11% for LCP 82-89. Johnsongrass control on July 15 was highest when Asulox was applied May 15 and June 15, and was reflected in reduced numbers of johnsongrass panicles. Sugarcane stalk population, however, was lowest when Asulox application was delayed until June 15. Compared with the April 15 application, sugarcane stalk yield was reduced 20 and 12% for LCP 82-89 and CP 72-370, respectively, when Asulox application was delayed until June 15. Cane yield for all cultivars was significantly increased, regardless of time of Asulox application, when compared with the untreated checks. Results demonstrate the importance of timely application of Asulox and indicate that it is better to apply too early than too late. Early elimination of johnsongrass competition is critical to maximizing early-season tillering which affects stalk population at harvest. Also of significance is that even though visual control of johnsongrass in some cases would not be considered acceptable, increases in sugarcane stalk population and yield when compared with the untreated check were realized.

Influence of Time of Rainfall Following Asulox Application on Johnsongrass Control:

Rainfall simulators were constructed to evaluate the effect of time of simulated rainfall washoff following Asulox application on johnsongrass control. Rainfall simulators were equipped with industrial nozzles and flow rate was adjusted to closely approximate water droplet size and velocity of a typical thunderstorm in which 1/2 inch of water is received within a 15 minute time period. When compared with the 48 hour washoff treatment, johnsongrass control 6 weeks after treatment was reduced when rainfall washoff occurred at 0 (immediately after application), 3, and 6 hours, but johnsongrass control following Asulox washoff at 12 hours was similar to the 48 hour treatment. Johnsongrass dry biomass for all treatments except the 0

washoff was equivalent to the 48 hour washoff treatment. Response to time of washoff was similar regardless of whether Dyneamic or Agridex was added to the spray solution.

Asulox/Fertilizer Interaction Studies:

These studies were conducted to determine the effect on johnsongrass control when Asulox was applied 3 days before fertilization, the same day of fertilization, and 3, 7, 10, and 14 days after fertilization. The premise of this study was that the physical injury to the roots of the johnsongrass plant during fertilizer application may decrease the uptake and movement of Asulox into the plant resulting in decreased weed control. Results suggest that in order to avoid decreased johnsongrass control, Asulox application should be made at least 3 days prior to fertilization or 10 days after fertilization.

Nutsedge Control in Sugarcane:

Purple nutsedge control with MON 12000 (an experimental from Monsanto Company) was 90% 35 days after treatment when applied at 0.064 lb/A and 49% at 0.016 lb/A. Sugarcane injury was minimal.

Sugarcane Tolerance to Herbicides Applied Postemergence:

Sugarcane injury 4 weeks after treatment was excessive for Cadre, but was minimal for F6285, MON 13200, MON 12000, and Karmex. Sugarcane stalk population measured in mid-September were similar for all herbicide treatments.

MANAGING FOR STUBBLE LONGEVITY WITH KLEENTEK AND FIELD-RUN CP 72-370
(Third Stubble Response)

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Iberia Research Station
and
Ray Ricaud and A. Arceneaux, Agronomy Dept.

Summary:

Of the four (4) variables evaluated in this study the Kleentek source of CP 72-370 seed provided the most consistent yield advantage throughout the sugarcane cycle. The cane cycle gain for Kleentek CP 72-370 over its field-run counterpart was over 5,500 pounds of sugar per acre **(Note - only Kleentek plots were harvested in third stubble, because field-run plot stands were considered too thin for yield determination)**. As an average of crops in the cycle, Kleentek cane produced more millable stalks, but slightly inferior juice quality. Ratoon Stunting Disease infection level was considerable higher for field-run cane. Response of CP 72-370 stubble to soil application of the pesticides Furadan and Ridomil also has been consistent throughout the cane cycle. Each crop year cane and/or sugar yields were reduced by Ridomil (reduction was significant in plantcane and second stubble), but Furadan did not affect yields in any year. Post-harvest soil cover of stubble resulted in erratic yields, with soil cover giving a significant increase in cane yield after the severe cold of December 1989, but resulting in a significant reduction in third stubble cane yield. Various combinations of the four variables yielded unremarkable results and, therefore, are discounted.

Introduction:

Successful advanced-stubble crops help spread the high costs associated with fallow activities, seedbed preparation and plantcane establishment. Many have suggested factors for the cause of stubble decline, including severity and timing of low winter temperatures, excessive wet conditions during the dormancy period, complex of stubble/root diseases, insects and weeds, insufficient soil aeration, harvest time and conditions and genetic predisposition. Identifying the genetic, cultural and chemical options to help avoid stubble burnout should be high on the research agenda. Several researchers are investigating different methods and approaches to enhancing stubble yields and number of stubble crops. The objective of this investigation is to measure
the response through the cane cycle of both Kleentek and field-run CP 72-370 to all possible combinations of post-harvest soil cover, Furadan and Ridomil. The uniqueness of this research is the combination of variables and the heavy soil texture used.

Partially supported by the American Sugar Cane League. Fertilizer was provided by Ouachita Fertilizer Co.

Procedures:

On September 21, 1988, forty-eight plots of CP 72-370 were planted. Management factors selected include Ridomil vs. no Ridomil, Furadan vs. no Furadan, post-harvest stubble soil cover vs. no cover and CP 72-370 Kleentek vs. field-run CP 72-370. The design used is a split-plot, with Ridomil treatments as main plots and other factor combinations factorially arranged on the subplots. Three replicates were utilized. Furadan was applied in-furrow at planting and in the off-bar each spring at the rate of 10 pounds of formulated material per acre. Ridomil was applied in liquid nitrogen fertilizer at 1 pint per acre for plantcane, first and third stubble, but at 2 pints per acre for second stubble. After harvest each year half of the plots were covered with 3 inches of soil. Each March the soil cover was shaved back to the original row height. Millable stalk population counts were made and certain plots were evaluated for Ratoon Stunting Disease and Sugarcane Mosaic Virus infection. Cane was harvested mechanically and weighed with a tractor-mounted hydraulic scale, except for third stubble plots when 10-stalk samples were harvested for weight measurements. Juice quality and stalk weight were determined using 10-stalk samples randomly selected from each plot. Data recorded for yield and its components were subjected to appropriated analyses of variance.

Results:

Figure no. 1 shows the consistency of the yield advantage of cane propagated from Kleentek seed. Averaged over all crops in the cycle Kleentek CP 72-370 exhibited significantly higher sugar and cane yields and millable stalks, but significantly lower levels of brix, sucrose, CRS and stalk weight. Undoubtedly accounting for the yield edge along with overall vigor was the disparity in RSD infection level (Figure no. 2). Field-run plots did not survive to third stubble.

Figure nos. 3 and 4 detail the response of cane to the soil applied pesticides, Ridomil and Furadan. The application on Ridomil in liquid fertilizer suppressed sugar yield in each year of the cycle; with significant reductions occurring in plantcane and second stubble. On the other hand, the response of cane to the application of Furadan was unremarkable. The failure to achieve a positive result with Furadan on the heavy-textured soil used in this investigation is in opposition to the response to Furadan achieved on light-textured soil, where nematodes and/or root-feeding insects may have been prevalent and accounted for the treatment response. These pests are normally not troublesome on a heavy-textured soil like that used in this investigation.

Covering stubble pieces prior to the extreme cold temperatures of December 1989, resulted in significantly higher first stubble yield (Figure no. 5). However, spring shaving to the original row height virtually eliminated the stand of third stubble cane. Early germinated buds, which were fostered by a mild winter, were removed by shaving. The concentration of buds in the upper profile of the row of the advanced stubble crop makes shaving even more problematical.

There were several interactions among the primary variables, but the only one with practical implications that involved a reversal in mean ranking was the year X soil cover interaction discussed in the preceding paragraph. Furthermore, mean squares for the main

effects were usually considerably higher in size than the interaction mean squares, suggesting that most of the variability noted was due to main effects, especially year, seed source and soil cover.

Fig. 1 - Kleentek Advantage Through the Sugarcane Cycle

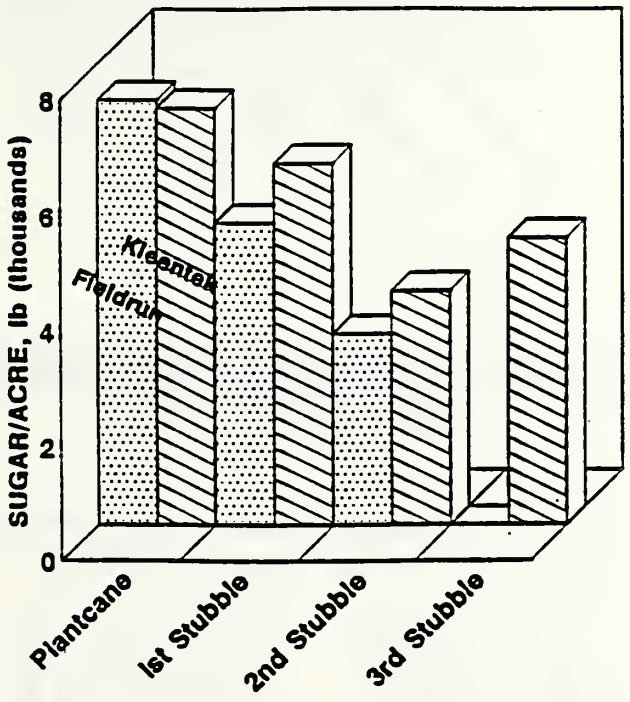


Fig. 2 - Ratoon Stunting Disease of Kleentek and Field-run CP 72-370

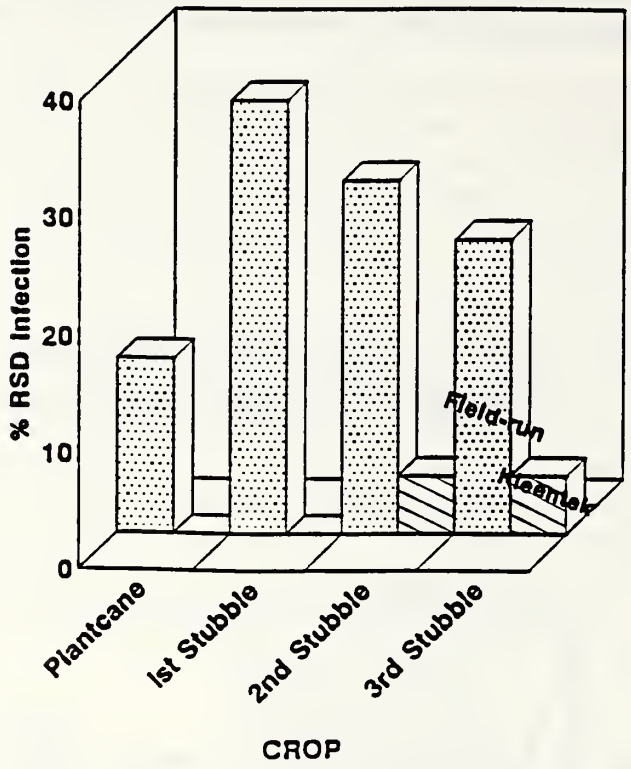


Fig. 3 - Cane Cycle Response to Soil Applied Ridomil

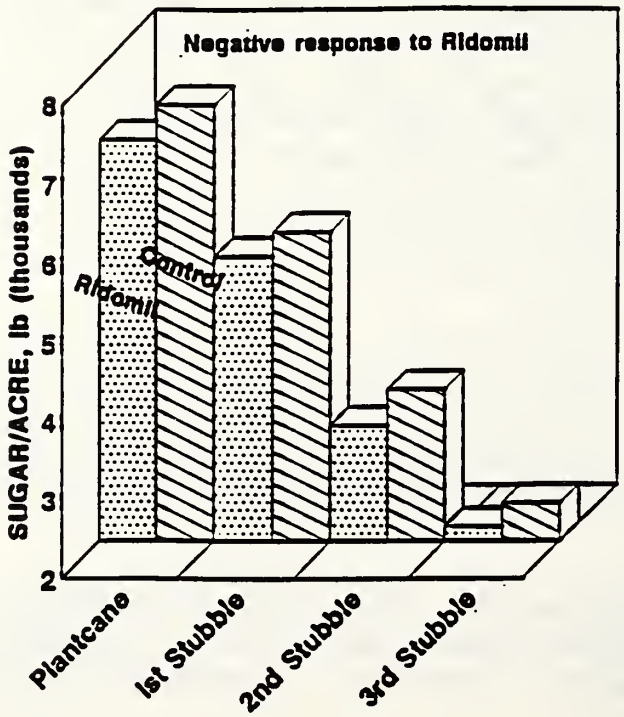


Fig. 4 - Cane Cycle Response to Soil Applied Furadan

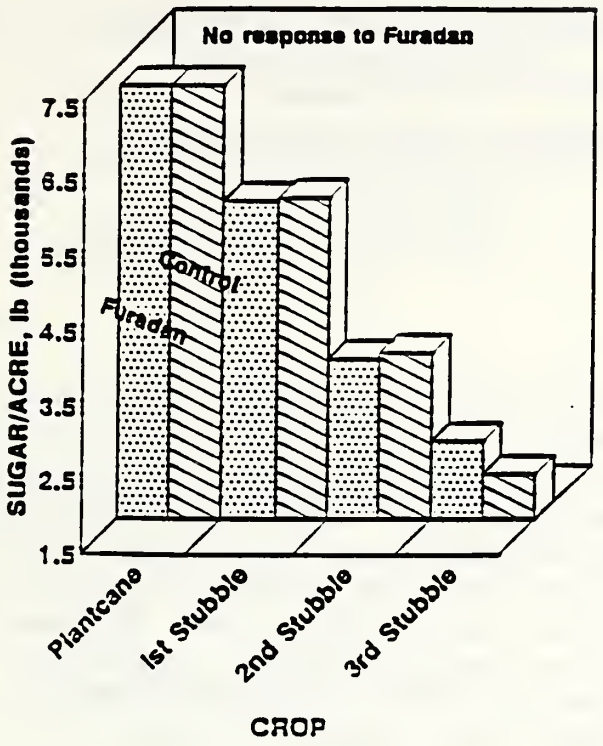
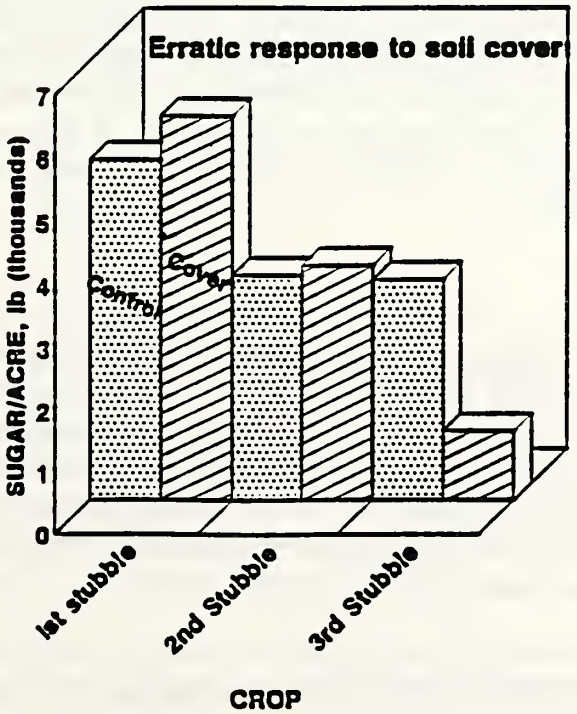


Fig. 5 - Cane Cycle Response to Post-harvest Soil Cover on Stubble



RESPONSE OF LCP 82-89 TO LEGUME COVER AND CASH CROPS
(First Stubble Response)

Howard P. Viator, Kenny Quebedeaux
and Jenny Hafley
Iberia Research Station

Summary:

Hairy vetch and soybean cover crops and soybeans for cash harvest were grown during the fallow period of the cane cycle. First stubble sugar yields of LCP 82-89 following the legumes were statistically similar to yields following a conventionally-managed fallow period. Nitrogen uptake measurements, calculated as the product of dry matter percentage and plant nitrogen content, demonstrated the capability of a soil, containing over 2% organic matter, to meet the nitrogen requirements of an unfertilized plantcane crop (organic nitrogen sources were not sufficient to produce adequate first stubble cane, which responded to applied nitrogen fertilizer). Fallow activity and seedbed preparation requirements, normally satisfied conventionally during the fallow period, can be accomplished during the period of legume occupation. Costs of one approach can be substituted for another.

Introduction:

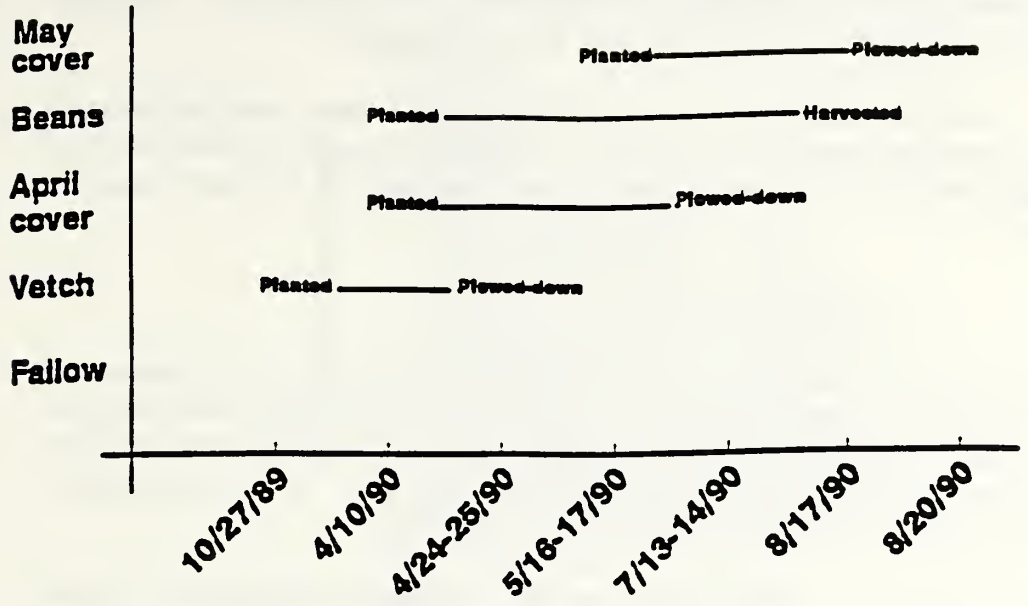
Sugarcane growers have opportunity to enhance cash flow, enrich and protect soil and substitute for conventional seedbed preparation costs by growing green manure and cash crops during the fallow period. It is, however, unclear to what degree these benefits accrue. Also, adverse consequences to subsequent cane crops is of concern to growers and landowners. Quantifiable research data on legume contributions to sugarcane production are virtually nonexistent. The primary objectives of this investigation are to quantify the benefits and/or consequences and measure the influence on soil properties of legume cover and cash crops grown in rotation with sugarcane. A corollary interest is the determination of the economic feasibility of legume rotations.

Experimental Procedures:

Dates for pertinent cultural events are shown in the date-line chart on the next page. Prior to the initiation of the study soil was sampled for organic matter content by compositing twelve randomly selected 6-in. deep cores from each plot. Hairy vetch was seeded at 30 pounds per acre after inoculation with appropriate N-fixing bacteria. The seed was planted on sugarcane rows using two drills spaced 18 inches apart. Vetch biomass samples (2' x 6') were harvested from the plots for nitrogen content determination by Kheldahl at the Forage Quality Evaluation Laboratory at the Southeast Research Station in Franklinton, LA. In April, Group III and IV

Research was supported by the American Sugar Cane League

Fallow-year Treatments



Date-line of Cultural Events

(Pioneer brand 9391 and Asgrow 4595, respectively) soybeans, intended for both cover and cash purposes, were seeded. Hairy vetch was flailed and incorporated in the rows at full bloom. A second soybean (Asgrow 4595) planting, intended only for cover purposes, was accomplished in May on plots which were fallowed since row establishment in the fall. All soybean plantings were accomplished using an IH air-seeder with planting units spaced 18 inches apart, using a planting rate of 6-8 seed per foot of row. Preemergence herbicides for all soybean plots were 1 1/2 pints
of Dual and 2/3 pounds of Lexone per acre. The fallow control plots also received the preemergence application of Dual + Lexone. Plot size was three rows, each 52 feet in length.

Benlate fungicide was applied on July 2, 1990, at the rate of 3/4 pound of formulated material per acre to protect all plots scheduled for bean harvest. Cover crop plots were not sprayed with Benlate. At early leaf drop, the early and late planted soybean treatments were sampled for nitrogen content, using a 5' section of row. LCP 82-89 sugarcane was planted on all plots on October 7, 1990 and will be grown through the cane cycle of stubble crops in order to measure the effects of the previously imposed cover and cash crop treatments. Nitrogen content of sugarcane was determined for whole plant samples at harvest. Six stalks, with leaves, of each plot were randomly selected and analyzed for nitrogen content using micro Kjeldahl.

Cane grown on the plots receiving the fallow-year treatments (fallow, cover and cash crops) will be fertilized with both a full and zero complement of recommended nitrogen fertilizer

each crop year to indirectly estimate the nitrogen credit attributable to each treatment. Soil organic matter changes will be monitored throughout the duration of the experiment. Treatments were evaluated using a randomized block design, with three replications.

The amounts of inorganic nitrogen fertilizer applied and the organic nitrogen measured from the legume crops will be reconciled with the total amount of nitrogen removed from and remaining in the experimental area at harvest. Economic comparisons will be made among the fallow-year treatments.

Results:

First stubble sugar/acre yields were not differentially influenced by the presence of legume crops during the fallow period (figure no.1). Yields were 6,294, 6236, 6190 and 5932 pounds of sugar per acre, respectively, for first stubble cane following the fallow check, soybean cash crop, soybean green manure and hairy vetch fallow-year treatments. All first stubble cane plots received a full complement of recommended nitrogen fertilizer.

This lack of yield variance is reflected in the amount of nitrogen measured in the above-ground sugarcane dry matter, as shown in figure no. 2. Averaged over fertilizer treatments, measured nitrogen uptake in first stubble ranged from 61.2 to 66.0 pounds of nitrogen per acre for cane following the hairy vetch and soybean cash treatments, respectively. Average nitrogen efficiency (cane tonnage to nitrogen uptake ratios) provides further confirmation of the similarities among treatments for nitrogen uptake and consequent cane yield in first stubble (table no. 1).

Assuming fallow activity and seedbed preparation requirements, normally satisfied conventionally during the fallow period, can be accomplished during the period of legume occupation, it should then be possible to substitute costs of one fallow-period approach for that of another.

Figure no. 1 - Sugar/Acre Response
to Fallow-year Legume Crops

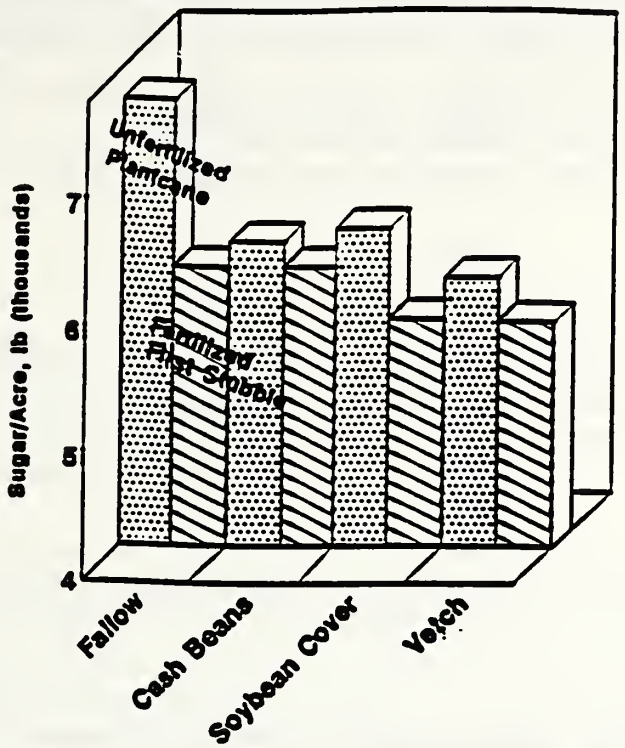


Figure no. 2 - Nitrogen Uptake (Above-ground)
of LCP 82-89 Following Fallow-year Legumes

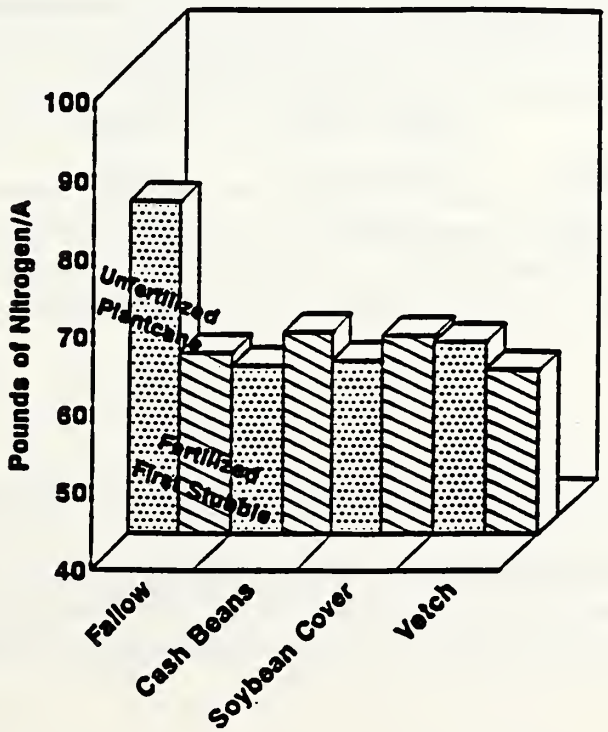


Table 1 First stubble tonnage yield, N uptake and efficiency of cane production per unit of N uptake.

Fallow-year treatment	Cane yield	N uptake	Cane yield to N uptake
	tons/a	lbs/a	lbs/a
Fallow check	28.0	63.3	885
Soybean cover	27.5	65.5	840
Cash soybeans	28.1	66.0	852
Hairy vetch	26.2	61.2	856
LSD (.05)	NS	NS	
CV,%	7.1%	13.8%	

Table 2 contrasts the costs of the four (4) fallow-year scenarios (budgets were generated by Dr. Art Heagler, Department of Agricultural Economics). The three legume fallow-year treatments are compared to standard practices of fallow plowing and seedbed preparation. The two treatments for which savings accrued relative to the standard practices were hairy vetch and cash soybeans, whereas, the cost of green manure soybeans exceeded that of the conventional practices.

Table 2 Cost and return comparisons of the four (4) fallow-year treatments.

	Fallow-year Treatment			
Item	Standard	Hairy vetch green manure	Soybean cash*	Soybean green manure
Cost	$162.14	$116.69	$194.11	$180.60
Income	-0-	-0-	$163.20	-0-
Saving		$ 45.45	$131.23	
Added cost				$ 18.46

* Soybeans priced at $5.10/bushel, yield at 32 bu/acre.

EFFECT OF COMPOSTED MUNICIPAL WASTE ON SUGARCANE PRODUCTION AND FERTILIZER REQUIREMENTS

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X. Wan, and L.P. Brown
Iberia Research Station and Agronomy Department

Summary:

Compost application rates up to 10 T/A semi-banded under cane at planting in 1990 to a Baldwin silty clay soil did not significantly affect first stubble cane yields in 1992. However, 1.0 T/A of compost sidebanded with fertilizer did increase both cane and sugar yield where 5.0 T/A of compost had been semi-banded under cane at planting.

Mixing compost rates up to 100 T/A with soil before cane planting increased sugar yields up to 1,290 lbs/A with plant cane on a Baldwin silty clay soil where fertilizer was not added. However, applying compost where fertilizer was used resulted in decreased cane yields which may have resulted from compost tying up the N applied in the fertilizer.

Fertilizer application did not affect plant cane yields on a Memphis silty loam, but compost worked into the soil before planting did increase cane tonnage.

Introduction:

Municipalities face a growing problem of how to safely dispose of their sewage sludge and solid waste. At present, due to lack of land and concern for the environment, many landfills are closed or are being closed. The landfill in Iberia Parish was terminated and solid waste is now trucked out of the parish at considerable cost. Surrounding parishes face the same problem. A possible solution to this situation is to make compost from sewage sludge and solid waste. The compost could then be used for agricultural purposes.

One approach for making compost is that used by the Bedminster Bioconversion Corporation. The "Bedminster Process" combines sewage sludge with solid waste in a "three day turning drum process". This results in a compost that is free of harmful organisms. Research is needed to determine whether this material may be safely and profitably used in growing sugarcane.

Objectives of our study were to:

1) Determine the effect of compost on sugarcane yields.

Research was supported by the Bedminster Bioconversion Corporation, the American Sugar Cane League, Iberia Parish Council, the City of New Iberia, Iberia Sugar Cooperative, Cajun Sugar Cooperative, Jeanerette Sugar Company, and M.A. Patout and Sons.

2) Determine whether compost can be economically used to replace or supplement commercial fertilizer in the growing of sugarcane.

3) Determine the effect of compost on the chemical composition of soil and sugarcane plants.

Procedures:

In October, 1990 a fertilizer by compost study was initiated at the Iberia Research Station on a Baldwin silty clay soil. The experiment consisted of the twelve treatments given in Table 2, replicated three times in a randomized complete block design. Experimental plots consisted of three 5'10" by 50' rows, separated by 6' alleys at the end of each plot.

All plots received either 0, 5, or 10 tons/A of compost (Table 2) applied to opened rows in early-October, 1990. The rows were
then closed until planting. In late-October the rows were opened and Kleentek variety CP65-357 was planted at three stalks and a lap of two joints. The rows were then closed to allow the sugarcane to germinate.

In March, 1991 the sugarcane rows were off-barred to allow the soil to warm up. In mid-April, the fertilizer and compost rates indicated in Table 2 were applied to the left off-bar of each row; the rows were "hipped-up" to cover the compost and fertilizer in the off-bar; and the cane was grown to maturity using standard cultural practices. In 1992 the same procedure was followed in obtaining the first stubble yield parameters (Tables 1 and 2).

Two additional compost by fertilizer experiments were initiated in the fall of 1991. The first was grown on a Baldwin silty clay soil at the Iberia Research Station at Jeanerette (Table 4), where compost was applied in early-October and spread across rows from furrow-to-furrow at 0, 20, 40, 60, 80, and 100 T/A (dry weight basis) and disked into the rows twice. The rows were then opened and planted to Kleentek variety CP70-321 at three stalks and a lap of two joints in mid-October.

The second test was grown on a Memphis silt loam soil at Youngsville in cooperation with Wilson Viator (Table 8). In this study, compost was applied at 0, 15, 30, 45, 60, and 75 T/A on top of the rows in early-September 1991 and disked into the rows twice. The rows were then opened in mid-September and planted with first progeny Kleentek variety CP70-321 at three stalks and a lap of two joints.

Both the Jeanerette and Youngsville tests used a randomized complete block design with three replications. Plots consisted of five 5'10" by 50' rows with 6' alleys at the ends of the plots and a border row separating the plots. Fertilizer was applied to the right off-bar of all rows receiving fertilizer in April of 1992 at 120 lbs N, 60 lbs P_2O_5, 80 lbs K_2O, and 24 lbs S/A. The rows were

"hipped-up" to cover the fertilizer, and cane was grown to maturity using standard cultural practices.

In September of 1992 sugarcane stalks in all plots, of all three studies, were counted to determine the effects of the treatments on plant population. The plots were then harvested in November and December of 1992 and weighed with a weigh rig. A ten stalk sample was taken from each plot to determine average stalk weight and juice quality.

Results and Discussion:

Compost and fertilizer treatments affected first-stubble plant population, CRS, cane yield, and sugar yield at Jeanerette in 1992 (Table 1). Compost applied with fertilizer in the spring of 1992 did not affect plant population or stalk weight, but did affect CRS at the 5 and 10 T/A compost rates, and increased cane and sugar yield at the 5 T/A compost rate (Table 2). Compost applied in the fall of 1990 did not affect stalk weight, plant population, cane yield, or sugar yield, but did decrease CRS.

Fertilizer application did not affect stalk weight, or CRS, but did increase plant population, cane yield, and sugar yield (Table 2).

Compost and fertilizer affected CRS, and cane and sugar yield of plant cane at Jeanerette in 1992 (Table 3). There was also a significant fertilizer by compost interaction for sugar yield. Fertilizer significantly increased sugar yields at 0, 20, and 40 T/A of compost, though the yield response became progressively smaller as compost rates were increased (Table 4). This indicates that compost was contributing to the fertilizer needs of the sugarcane. Similarly, increasing compost rates in the absence of fertilizer resulted in increased sugar yields. However, increasing compost from 0 to 20 T/A where fertilizer was applied resulted in a significant decrease in sugar yield (Table 4). This may have resulted from compost tying up the applied nitrogen fertilizer. Whatever the reason, further increasing compost rates (from 20-100 T/A) where fertilizer had been applied continued to increase yields, but did not result in larger yields than the 0 compost 1.0x fertilizer treatment (#2).

Fertilizer application to plant cane at Jeanerette in 1992 (Table 5) did not significantly affect stalk weight, plant population, or CRS, but did increase cane tonnage. Compost application did not affect stalk weight and plant population, but did decrease CRS and increased cane yield (Table 6).

Fertilizer did not significantly affect any of the plant cane yield parameters at Youngsville in 1992 (Tables 7 and 9). Compost, however, did affect both CRS and cane yields (Tables 7 and 10). The fertilizer x compost interaction was not significant for any of the measured variables (Tables 7 and 8).

Compost decreased CRS in 1992 at Youngsville with plant cane, but increased cane tonnage (Table 10). Since fertilizer did not significantly increase plant cane tonnage at Youngsville in 1992 (Tables 7 and 9), the yield response from compost (Table 10) could not be explained by N, P, K, or S in the compost.

Table 1. F-values for effect of fertilizer and compost addition on first stubble sugarcane yield parameters for a Baldwin silty clay soil at Jeanerette in 1992.

Source	df	Stalk wt.	Population	CRS	Cane yield	Sugar yield
Treatments	11	0.75	5.19**	2.19*	15.04**	15.46**
% CV		10.07	11.74	2.14	7.82	7.86
RMSE		0.1756	3449	4.481	1.813	381.1

* and ** denote statistical significance at the $P \leq 0.05$ and 0.01 levels, respectively. Remaining F-value was not significant at the $P \leq 0.10$ level.

Table 2. Effect of fertilizer and compost on first stubble yield parameters at Jeanerette in 1992.

T#	1990+ Compost	Fert.≠	1992§ Compost	Millable stalk Wt.	Millable stalk No.	CRS	Cane yield	Sugar yield
	T/A		T/A	lbs	1000/A	lbs/T	T/A	lbs/A
1	0	0	0	1.57	22.9	209	16.2	3,370
2	0	0.5x	0	1.70	29.3	212	25.0	5,310
3	0	0.5x	1.0	1.82	31.7	211	24.8	5,220
4	0	1.0x	0	1.83	32.3	213	25.9	5,500
5	5	0	0	1.72	25.2	205	17.2	3,530
6	5	0.5x	0	1.72	32.2	210	23.2	4,890
7	5	0.5x	1.0	1.77	31.2	216	26.0	5,620
8	5	1.0x	0	1.73	31.6	207	26.9	5,550
9	10	0	0	1.64	20.2	209	16.9	3,530
10	10	0.5x	0	1.82	29.8	212	23.9	5,070
11	10	0.5x	1.0	1.72	29.5	203	24.8	5,020
12	10	1.0x	0	1.89	36.6	205	27.4	5,630
LSD				NS	4.8	6	2.5	530

+ Compost rates are based on dry weight.
≠ The 1.0x fertilizer rate consisted of 120 lbs N, 60 lbs P_2O_5, 80 lbs K_2O, and 24 lbs S/A.
NS Denotes that the treatment means were not different at the $P \leq 0.10$ level.
§ Compost was applied in April of 1992 in the off-bar along with the fertilizer.

Table 3. F-values for effect of fertilizer and compost addition on plant cane yield parameters for a Baldwin silty clay soil at Jeanerette in 1992.

Source	df	Stalk wt.	Population	CRS	Cane yield	Sugar yield
Fert. (F)	1	2.36	0.09	0.57	19.42***	17.16***
Compost (C)	5	0.63	0.56	2.79*	4.31**	2.22$^{■}$
FXC	5	1.66	0.24	1.61	1.48	2.57$^{■}$
% CV		8.21	12.31	3.62	7.28	8.43
RMSE		0.1932	3828	7.221	2.265	523.4

$^{■}$,*,**, and *** denote statistical significance at the $P \leq 0.10$, 0.05, 0.01, and 0.001 levels, respectively. Remaining F-values were not significant at the $P \leq 0.10$ level.

Table 4. Effect of fertilizer and compost on plant cane yield parameters at Jeanerette in 1992.

T#	Compost+	Fert.≠	Millable stalk Wt.	Millable stalk No.	CRS	Cane yield	Sugar yield
	T/A		lbs	1000/A	lbs/T	T/A	lbs/A
1	0	0	2.27	31.4	202	26.4	5,230
2	0	1.0x	2.55	29.6	213	33.7	7,200
3	20	0	2.35	29.8	200	26.8	5,370
4	20	1.0x	2.47	29.2	206	29.9	6,150
5	40	0	2.07	29.9	191	28.3	5,400
6	40	1.0x	2.43	31.6	198	32.6	6,450
7	60	0	2.44	30.4	204	31.0	6,290
8	60	1.0x	2.23	32.5	195	32.0	6,230
9	80	0	2.39	33.0	197	31.3	6,160
10	80	1.0x	2.39	32.7	196	33.9	6,640
11	100	0	2.30	31.4	198	32.9	6,520
12	100	1.0x	2.34	32.6	195	34.6	6,750
LSD 0.10			NS	NS	NA	NA	730

+ Compost rates are based on dry weight.

≠ The 1.0x fertilizer rate consisted of 120 lbs N, 60 lbs P_2O_5, 80 lbs K_2O, and 24 lbs S/A.

NA Denotes that the LSD value is not given because the compost x fertilizer interaction was not significant at the $P \leq 0.10$ level.

NS Denotes that the treatment means were not different at the $P \leq 0.10$ level.

Table 5. Effect of fertilizer on plant cane yield parameters at Jeanerette in 1992.

Fert.	Millable stalk Wt.	Millable stalk No.	CRS	Cane yield	Sugar yield
	lbs	1000/A	lbs/T	T/A	lbs/A
0	2.30	31.0	198	29.5	5,840
1.0x	2.40	31.4	200	32.8	6,570
LSD 0.10	NS	NS	NS	1.3	NA

NS Denotes that fertilizer did not affect the indicated yield parameters.
NA Denotes that the LSD value is not given because the compost x fertilizer interaction was significant at the $P \leq 0.10$ level.

Table 6. Effect of compost on plant cane yield parameters at Jeanerette in 1992.

Compost	Millable stalk Wt.	Millable stalk No.	CRS	Cane yield	Sugar yield
T/A	lbs	1000/A	lbs/T	T/A	lbs/A
0	2.41	30.5	207	30.1	6,260
20	2.41	29.5	203	28.4	5,760
40	2.25	30.7	194	30.5	5,920
60	2.34	31.5	199	31.5	6,260
80	2.39	32.9	196	32.6	6,400
100	2.32	32.0	196	33.8	6,630
LSD 0.10	NS	NS	7	2.3	NA

NS Denotes that compost did not significantly affect the indicated yield parameters.
NA Denotes that the LSD value is not given because the compost x fertilizer interaction was significant at the $P \leq 0.10$ level.

Table 7. F-values for effect of fertilizer and compost addition on plant cane yield parameters for a Memphis silt loam soil at Youngsville in 1992.

Source	df	Stalk wt.	Population	CRS	Cane yield	Sugar yield
Fert. (F)	1	0.95	0.30	0.49	2.17	2.48
Compost (C)	5	0.29	0.90	2.99*	2.69*	2.07
FXC	5	0.54	0.72	0.45	0.67	0.19
% CV		6.98	7.59	3.99	6.10	7.66
RMSE		0.1553	2231	8.023	1.766	446.0

* Denotes statistical significance at the $P \leq 0.05$ level. Remaining F-values were not significant at the $P \leq 0.10$ level.

Table 8. Effect of fertilizer and compost on plant cane yield parameters at Youngsville in 1992.

T#	Compost+	Fert.+	Millable stalk Wt.	Millable stalk No.	CRS	Cane yield	Sugar yield
	T/A		lbs	1000/A	lbs/T	T/A	lbs/A
1	0	0	2.23	28.5	209	26.9	5,630
2	0	1.0x	2.26	28.2	210	27.9	5,850
3	20	0	2.23	30.5	198	28.9	5,720
4	20	1.0x	2.33	31.1	200	30.9	6,200
5	40	0	2.27	27.8	202	26.7	5,410
6	40	1.0x	2.14	31.1	198	29.0	5,750
7	60	0	2.23	30.4	202	30.7	6,190
8	60	1.0x	2.13	29.4	210	30.4	6,390
9	80	0	2.25	29.5	199	28.3	5,640
10	80	1.0x	2.18	28.8	198	29.3	5,810
11	100	0	2.29	28.4	192	29.5	5,650
12	100	1.0x	2.16	29.0	196	28.9	5,650
LSD 0.10			NS	NS	NA	NA	NS

+ Compost rates are based on dry weight.

+ The 1.0x fertilizer rate consisted of 120 lbs N, 60 lbs P_2O_5, 80 lbs K_2O, and 24 lbs S/A.

NA Denotes that the LSD value is not given because the compost x fertilizer interaction was not significant at the $P \leq 0.10$ level.

NS Denotes that the treatment means were not different at the $P \leq 0.10$ level.

Table 9. Effect of fertilizer on plant cane yield parameters at Youngsville in 1992.

Fert.	Millable Stalk Wt.	Millable Stalk No.	CRS	Cane yield	Sugar yield
	lbs	1000/A	lbs/T	T/A	lbs/A
0	2.25	29.2	200	28.5	5,710
1.0x	2.20	29.6	202	29.4	5,940
LSD 0.10	NS	NS	NS	NS	NS

NS Denotes that fertilizer did not significantly affect the indicated yield parameters.

Table 10. Effect of compost on plant cane yield parameters at Youngsville in 1992.

Compost	Millable stalk Wt.	Millable stalk No.	CRS	Cane yield	Sugar yield
T/A	lbs	1000/A	lbs/T	T/A	lbs/A
0	2.25	28.4	210	27.4	5,740
15	2.28	30.8	199	29.9	5,960
30	2.21	29.4	200	27.9	5,580
45	2.18	29.9	206	30.5	6,290
60	2.22	29.1	198	28.8	5,720
75	2.22	28.7	194	29.2	5,650
LSD 0.10	NS	NS	8	1.8	NS

NS Denotes that the indicated variables were not significantly affected by compost application.

EFFECT OF NITROGEN AND CALCIUM CHLORIDE ON SUGARCANE YIELD PARAMETERS

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Summary:

The effects of liquid urea (0, 60, 120, and 180 lbs N/A) and calcium chloride (0, 20, and 40 lbs Ca/A) were tested on plant cane and first stubble yield parameters.

With plant cane, application of calcium chloride increased stalk weight and decreased CRS, while nitrogen progressively increased cane and sugar yields.

In first stubble cane, nitrogen again progressively increased cane and sugar yields. Applying 40 lbs Ca/A as calcium chloride increased sugar/A by 680 lb. These results suggest that adding calcium chloride to liquid urea can increase sugar yields in stubble cane.

Introduction:

Sugarcane production in Louisiana is limited by the relatively rapid deterioration in stubble crop yields. This results in the expensive practice of replanting every third or fourth year. Also, stubble crops require higher fertilizer rates than plant cane, while producing less cane per acre.

The decrease in cane yields and increased fertilizer needs of stubble crops are thought to be related to the deterioration of the sugarcane root system. Consequently, if cultural practices could be identified that reduce, or delay, the deterioration of the sugarcane root system, it should be possible to increase fertilizer use efficiency and yields.

Research with other crops indicates that adding calcium chloride to liquid urea in a soil fertilization program can increase yields. Thus far, however, the effects of calcium chloride on sugarcane yields have not been determined.

Objectives of our study were to:

1) Determine whether calcium chloride can increase sugarcane yields.

2) Determine whether calcium chloride can reduce the N fertilizer requirements of sugarcane.

Procedures:

In October of 1990, a urea x calcium chloride soil fertility study was initiated at the Iberia Research Station on a Baldwin silty clay soil. The experiment consisted of the twelve treatments given in Table 2, replicated three times in a randomized complete block design. Experimental plots consisted of three 5'10" by 50' rows, separated by 6' alleys at the ends of each plot.

In late October of 1990, the sugarcane rows were opened and variety CP65-357 was planted at three stalks and a lap. The rows were then closed to allow the sugarcane to germinate.

In April of 1991 and 1992, liquid urea and liquid calcium chloride were added to the right off-bar at the N and Ca rates given in Table 2. Phosphorus and K were blanket applied to the left off-bar of all rows in the study at 60 lbs P_2O_5 and 80 lbs K_2O/A. The rows were "hipped-up" to cover the fertilizer in the off-bar, and the cane was then grown to maturity using standard cultural practices.

Results and Discussion:

Table 1 shows the effect of liquid urea (N) and liquid calcium chloride (Ca) on plant cane yield parameters in 1991. Nitrogen affected cane and sugar yields, while calcium affected stalk weight and CRS. Since the NxCa interaction for the variables were all nonsignificant (Table 1), LSD values are not given in Table 2.

Table 3 shows that nitrogen fertilization progressively increased both cane and sugar yields, but did not affect stalk weight and CRS. Calcium fertilization increased stalk weight and decreased CRS, but had no effect on cane and sugar yield (Table 4).

Nitrogen fertilization affected first stubble cane and sugar yields again in 1992 (Table 5). However, calcium chloride did not affect stalk weight and CRS in 1992 as it did in 1991, though it did significantly affect sugar yields. Since the NxCa interaction for all the variables were nonsignificant (Table 5), LSD values are not given in Table 6.

Table 7 shows that nitrogen fertilization in 1992 progressively increase both cane and sugar yields, but did not affect stalk weight or CRS. Calcium chloride also increase sugar yield, but did not significantly affect cane yield, stalk weight, or CRS (Table 8). These results indicate that using calcium chloride in growing sugarcane may have merit. The effects of liquid urea and liquid calcium chloride on cane and sugar yields in second and third stubble cane will be investigated in 1993 and 1994, respectively.

Table 1. F-values for a plant cane nitrogen x calcium study on a Baldwin silty clay soil at Jeanerette in 1991.

Source	df	Stalk wt.	CRS	Cane yield	Sugar yield
Nitrogen (N)	3	1.78	0.14	13.33****	8.95***
Calcium (Ca)	2	5.71**	2.93*	0.53	1.10
NxCa	6	0.11	0.44	1.13	0.78
% CV		5.43	6.12	6.51	8.624
RMSE		0.1510	10.78	2.290	534.4

*, **, ***, and **** denote statistical significance at the $P \leq 0.10$, 0.01, 0.001, and 0.0001 levels, respectively. Remaining F-values were nonsignificant at the $P \leq 0.10$ level.

Table 2. Effect of nitrogen and calcium chloride on plant cane yield parameters at Jeanerette in 1991.

T#	N+	Ca±	Stalk wt.	CRS	Cane yield	Sugar yield
	---- lbs/A ----		lbs	lbs/T	T/A	lbs/A
1	0	0	2.57	178	30.9	5,520
2	0	20	2.73	172	32.0	5,510
3	0	40	2.77	175	31.5	5,510
4	60	0	2.73	184	36.9	6,770
5	60	20	2.90	164	35.1	5,730
6	60	40	2.88	180	33.3	6,000
7	120	0	2.65	182	34.2	6,220
8	120	20	2.85	169	37.5	6,330
9	120	40	2.83	177	36.0	6,370
10	180	0	2.70	180	39.0	7,000
11	180	20	2.83	177	37.8	6,680
12	180	40	2.93	178	37.8	6,730
LSD 0.10			NA	NA	NA	NA

+ Nitrogen was applied as liquid urea.

± Calcium was applied as liquid calcium chloride with the liquid urea.

NA Denotes that the LSD value is not given because the NxCa interaction was nonsignificant at the $P \leq 0.10$ level.

Table 3. Effect of nitrogen on plant cane yield parameters at Jeanerette in 1991.

N	Stalk wt.	CRS	Cane yield	Sugar yield
lbs/A	lbs	lbs/T	T/A	lbs/A
0	2.69	175	31.5	5,510
60	2.84	176	35.1	6,170
120	2.78	176	35.9	6,310
180	2.82	178	38.2	6,800
LSD 0.10	NS	NS	1.9	430

NS Denotes that nitrogen fertilization did not affect the indicated yield parameters at the $P \leq 0.10$ level.

Table 4. Effect of calcium chloride on plant cane yield parameters at Jeanerette in 1991.

Ca	Stalk wt.	CRS	Cane yield	Sugar yield
lbs/A	lbs	lbs/T	T/A	lbs/A
0	2.66	181	35.3	6,380
20	2.83	170	35.6	6,060
40	2.85	178	34.7	6,150
LSD 0.10	0.11	8	NS	NS

NS Denotes that the indicated variables were not affected by calcium chloride at the $P \leq 0.10$ level.

Table 5. F-values for a first stubble nitrogen x calcium study on a Baldwin silty clay soil at Jeanerette in 1992.

Source	df	Stalk wt.	CRS	Cane yield	Sugar yield
Nitrogen (N)	3	0.55	1.00	13.42****	15.44****
Calcium (Ca)	2	1.80	0.68	2.35	3.09*
NxCa	6	0.79	1.08	0.57	0.60
% CV		11.19	3.05	13.24	13.08
RMSE		0.1976	6.748	3.208	700.3

* and **** denote statistical significance at the $P \leq 0.10$ and 0.0001 levels, respectively. Remaining F-values were nonsignificant at the $P \leq 0.10$ level.

Table 6. Effect of nitrogen and calcium chloride on first stubble yield parameters at Jeanerette in 1992.

T#	N+	Ca±	Stalk wt.	CRS	Cane yield	Sugar yield
	----- lbs/A -----		lbs	lbs/T	T/A	lbs/A
1	0	0	1.87	216	19.7	4,260
2	0	20	1.76	214	19.8	4,220
3	0	40	1.76	225	19.6	4,400
4	60	0	1.58	224	21.5	4,800
5	60	20	1.76	220	23.2	5,070
6	60	40	1.76	218	23.2	5,060
7	120	0	1.65	219	24.4	5,320
8	120	20	1.69	225	24.5	5,500
9	120	40	1.95	222	28.9	6,410
10	180	0	1.70	222	26.5	5,890
11	180	20	1.78	222	28.0	6,180
12	180	40	1.93	227	31.5	7,140
LSD 0.10			NS	NS	NA	NA

+ Nitrogen was applied as liquid urea.
± Calcium was applied as liquid calcium chloride in the liquid urea.
NS Denotes that the indicated variables were not affected at the $P \leq 0.10$ level.
NA Denotes that the LSD value is not given because the NxCa interaction was nonsignificant at the $P \leq 0.10$ level.

Table 7. Effect of nitrogen on first stubble yield parameters at Jeanerette in 1992.

N	Stalk wt.	CRS	Cane yield	Sugar yield
lbs/A	lbs	lbs/T	T/A	lbs/A
0	1.80	218	19.7	4,290
60	1.70	221	22.6	4,980
120	1.76	222	26.0	5,750
180	1.81	223	28.7	6,400
LSD 0.10	NS	NS	2.6	570

NS Denotes that nitrogen fertilization did not affect the indicated yield parameters at the $P \leq 0.10$ level.

Table 8. Effect of calcium chloride on first stubble yield parameters at Jeanerette in 1992.

Ca	Stalk wt.	CRS	Cane yield	Sugar yield
lbs/A	lbs	lbs/T	T/A	lbs/A
0	1.70	220	23.0	5,070
20	1.75	220	23.9	5,250
40	1.85	223	25.8	5,750
LSD 0.10	NS	NS	NS	490

NS Denotes that the indicated variables were not affected by calcium chloride at the $P \leq 0.10$ level.

CULTURAL PRACTICE RESEARCH WITH SUGARCANE IN 1992

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in cooperation with the
St. Gabriel Research Station

SUMMARY:

Eleven field experiments were conducted on cultural practices in sugarcane in 1992. The experiments were on dates and rates of planting, depths of seed cover, dates of harvest, stubble longevity and stubble diggers.

Results showed that the average yields of four varieties were higher in plant cane by planting in October than in September or November. Cane yields were higher with a four-stalk planting rate than two- and three- stalk rates in plant cane, but not in stubble cane. Plant and first stubble yields were higher where seed cane was covered with 3-4 rather than 7-8 inches of packed soil at planting time. The removal of excessive soil cover by shaving in the spring did not improve yield.

Plant cane yields were higher when harvested in November than in October and December. The subsequent first yields of four varieties were higher where the plant cane was harvested in December than earlier in the season. In a stubble longevity test, the yield of first stubble was increased with fall applied fertilizer at planting time and stubble soil cover, but not with Furadan. In another test, the yield of first stubble was increased by covering the cane stubbles immediately after harvesting plant cane and without removing the cover in spring. Shaving cane stubbles in the spring reduced first stubble yields and the use of stubble digger and Lilliston cultivator after shaving increased yield only in one of four varieties tested.

OBJECTIVES:

This research was designed to provide information on cultural practices in an effort to help cane growers to produce maximum economic yields and to increase profitability in sugarcane production. This annual progress report is presented to provide the latest available data on certain practices and not as a final recommendation for growers to use all of these practices. Recommendations are based on several years of research data.

This research was supported in part by grant funds from the American Sugarcane League.

RESULTS AND DISCUSSION:

Eleven field experiments were conducted on cultural practices for sugarcane in 1992. The winter temperatures prior to the 1992 crop were mild and severe freeze damage to cane stubbles did not occur in the experiments. However, cane yields were adversely affected by hurricane force winds in August and a killing freeze in November, 1992.

Date of Planting

An experiment was initiated to test the effects of planting dates on the plant cane yield of four varieties of sugarcane. The dates tested were September 1, October 1 and November 1, 1991 and the varieties were CP 70-321, CP 72-370, CP 79-318 and LCP 82-089. The last variety is newly released from the LSU Breeding Program. The data obtained are reported in Table 1. The results show that the October planting produced the highest yield with all the varieties tested. The November planting produced the lowest yield with all varieties except with CP 72-370. As an average of varieties, significantly more cane and sugar yield was produced from the October date over the September and from September over the November date. Germination of the seed cane planted in November was low apparently due to a mild freeze before planting in 1991.

Another test was continued in 1992 from plant cane in 1991 to test dates of planting on first stubble yield. The dates were September 4, October 1 and November 1 in 1990, and the varieties were the same as in the above plant cane test. The varieties were planted on each date in 1990 and harvested as plant cane in 1991 and first stubble in 1992. The data obtained in first stubble are reported in Table 2. The results show that higher yields of first stubble were produced from the September than the October and November planting dates in LCP 82-089. As an average of varieties, higher yields were produced from the September than November planting date.

Rate of Planting

An experiment was initiated to test the effects of rates of planting on plant cane yield of four varieties. The rates tested were two, three and four stalks planted in continuous lines with a 10% overlap. The varieties were CP 65-357, CP 72-370, CP 74 -383 and LCP 82-089. The varieties were planted at each rate in 1991 and harvested as plant cane in 1992. The data are shown in Table 3. The four-stalk rate produced more plant cane yield than the two-stalk rate in LCP 82-089. As an average of varieties, the four-stalk rate produced more than the two- and three-stalk rates.

Another test was continued in 1992 from plant cane in 1991 to test planting rates on first stubble yield of three varieties. The rates were two, three and four stalks and the varieties were CP 65-357, CP 72-370 and CO 74-383. The varieties were planted at each rate in 1990 and harvested as plant cane in 1991 and first stubble in 1992. The first stubble results are reported in Table 4. The differences in stubble yield due to the rates of planting were small in this test.

Depth of Seedcane Cover

An experiment was initiated to test the effects of seed cover and shaving on the plant cane yield of CP 72-370 and LCP 82-089. The rows in all plots were furrowed for planting at a normal depth and the cover depths tested were 3-4, 5-6 and 7-8 inches of packed soil. Seedcane of each variety was covered with each soil depth in 1991. A shave and no shave treatments were applied to each cover depth in spring of 1992. The shave treatment left three inches of soil on all the shaved plots. The data obtained are reported in Table 5. The 7-8 depths produced less plant cane yield than the 5-6 depth without shaving in CP72-370. As an average the 7-8 depth produced less yield than the 3-4 depth. The shaving treatment to remove excessive soil cover in the spring did not improve cane yield.

Another test was continued in 1992 from plant cane in 1991 to test seed cover depths and shaving on first stubble yield of CP 65-357 and CP 70-321. The same treatments were applied in the plant cane in 1991 as in the above plant cane test and no treatments were applied in the first stubble in 1992. The effects of the treatments in plant cane on first stubble yield are shown in Table 6. The 7-8 inches of cover depth produced less cane yield than the 3-4 depth in CP 65-357 and the 5-6 depth in CP 70-321 without shaving. As an average, 7-8 depth produced less yield than the 3-4 depth of seed cover. The effect of shaving to remove excessive soil cover was small.

Date of Harvest

Experiments were conducted on dates of harvesting different varieties of sugarcane. One test was initiated to measure the effects of harvest dates in plant cane in 1991 and the following first stubble in 1992. Varieties CP 70-321, CP 72-370, CP 79-318 and LCP 82-089 were harvested in plant cane on September 4, October 1, November 1 and December 1 in 1991. The effects of the plant cane harvest dates on yield of first stubble in 1992 are reported in Table 7. The results show that the November and December plant cane harvest dates produced more first stubble yield than the September and October dates in each variety except LCP 82-089. The December date produced more yield than the November date in CP 72-370. As an average of varieties, first stubble yields were higher where the plant cane was harvested in November and December than in September and October.

Another test was initiated to measure the effects of harvest dates in plant cane on the yield of plant cane in 1992 and first stubble in 1993. Varieties CP70-321, LCP82-089, LHO83-153 and LCP85-384 were harvested in plant cane on Sept. 1, Oct. 1, Nov. 10 and Dec. 1 in 1992. The plant cane data for the last three harvest dates are reported in Table 8. The cane yields in November were higher than in October in each variety and higher than in December in LCP82-089 and LCP85-384. Generally, the percent sucrose increased during the harvest in each variety. As an average of varieties, the cane and sugar yields were significantly higher when the plant cane was harvested in November and December than October, but higher in November than December. The relative low yields in December were due to cane damage from hurricane force winds and an early killing freeze causing poor topping and harvesting conditions.

Stubble Longevity

An experiment was initiated in 1991 and continued in first stubble cane in 1992 to test the effects of fall applied fertilizers, Furadan and stubble soil cover on the stubble yield. Varieties CP72-370 and CP74-383 were planted int he test. A 90-90-90 fertilizer treatment was applied at planting time and Furadan was applied at planting time and in spring of 1991 and 1992. A soil cover treatment was applied after harvesting the plant cane crop in 191.

The mean effect of each treatment in first stubble cane are reported in Table 9. The cane and sugar yields were significantly increased with the fertilizer applied at planting time and stubble soil cover, but not with the Furadan. The yield increase from the soil cover was not as large as normal due to mild winter temperatures prior to the 1992 crop.

Another experiment was conducted in first stubble cane to test the effects of dates of stubble soil cover after two harvest dates with and without shaving in the spring to remove the soil cover. Varieties CP72-370 and CP74-383 were harvested as plant cane on October 1 and December 1 in 1991. The dates of the sol cover treatments were Cover 1 which was applied immediately after each harvest date and Cover 2 which was applied at the end of the harvest season in 1991. The first stubble yield data obtained in 1992 are reported in Table 10.

The results show that the Cover 2 shave treatment decreased cane yields when applied after the October harvest dates in both varieties, but it increased yield when applied after the December harvest in CP72-370. As an average of harvest dates and varieties, cane yields were significantly increased only with the Cover 1 treatment applied immediately after harvesting and without shaving in the spring to remove the cover. Apparently, cane shoots grew through the soil cover and the removal of cover by shaving was not necessary in this test.

Shaver, Stubble Digger and Lillistron

An experiment was conducted in 1992 to evaluate the use of a stubble shaver, stubble digger and a Lillistron cultivator on cane stands and yield of first stubble cane. Each tool was tested in varieties CP65-357, CP70-321, CP72-370 and CP74-383. The cane stubbles were shaved to ground level prior to applying the digger and cultivator in the spring of 1992. The data obtained are shown in Table 11. The stubble shaver alone decreased cane yield in CP74-383. The stubble digger and Lillistron applied after shaving increased cane yield only in CP 65-357. As an average of varieties, the cane yields were not significantly increased with the use of a digger and Lillistron cultivator. There was a tendency for the use of a shaver alone to decrease stubble cane yield in each variety.

Table 1. Effect of date of planting on the plant cane yield of four varieties of sugarcane on Commerce soil on the St. Gabriel Research Station, 1992.

Variety of cane	Date of planting	Plant cane yield	Stalk weight	Normal juice		Sugar yield
				Brix	Sucrose	
	1991	T/A	lbs.	%	%	lbs/A
CP 70-321	Sept.1	35.2	2.73	18.0	15.5	7901
	Oct. 1	43.3	2.66	18.3	15.6	9834
	Nov. 1	30.3	2.69	18.2	15.6	6840
CP 72-370	Sept. 1	32.0	2.52	17.5	14.7	6771
	Oct. 1	39.3	2.61	17.7	14.8	8349
	Nov. 1	33.5	2.50	17.2	14.2	6749
CP 79-318	Sept. 1	32.0	2.84	16.8	14.2	6530
	Oct. 1	43.2	3.29	17.5	15.0	9346
	Nov. 1	26.3	3.53	17.3	14.6	5522
LCP 82-089	Sept. 1	33.3	2.16	18.0	15.1	7267
	Oct. 1	37.5	2.13	18.0	15.3	8302
	Nov. 1	21.9	2.58	18.5	15.6	4973
LSD .05 Treatments		3.2	0.41	0.5	0.6	768
		Mean planting date effect				
	Sept. 1	33.1	2.57	17.6	14.9	7117
	Oct. 1	40.8	2.67	17.9	15.2	8958
	Nov. 1	28.0	2.82	17.8	15.0	6021
LSD .05 Means		1.6	0.21	0.3	NS	385

Table 2. Effect of date of planting on the first stubble cane yield of four varieties of sugarcane on Commerce soil on the St. Gabriel Research Station, 1992.

Variety of cane	Date of planting	Stubble cane yield	Stalk weight	Normal juice		Sugar yield
				Brix	Sucrose	
	1990	T/A	lbs.	%	%	lbs/A
CP 70-321	Sept. 4	32.9	2.05	17.5	15.1	7170
	Oct. 1	30.6	1.99	17.7	15.3	6818
	Nov. 1	28.9	2.16	17.7	15.1	6325
CP 72-370	Sept. 4	29.8	2.02	17.1	14.6	6228
	Oct. 1	31.5	2.01	17.7	15.0	6828
	Nov. 1	31.7	2.35	17.7	15.0	6857
CP 79-318	Sept. 4	32.0	2.48	16.7	14.4	6598
	Oct. 1	31.2	2.55	17.2	14.9	6710
	Nov. 1	29.0	2.68	17.1	14.6	6093
LCP 82-089	Sept. 4	27.7	1.85	18.1	15.4	6207
	Oct. 1	22.8	1.67	17.4	14.8	4866
	Nov. 1	23.6	1.73	18.0	15.3	5205
LSD .05 Treatments		3.6	0.19	1.0	1.2	1000
		Mean planting date effect				
	Sept. 4	30.6	2.10	17.4	14.9	6551
	Oct. 1	29.0	2.05	17.5	15.0	6305
	Nov. 1	28.3	2.23	17.6	15.0	6120
LSD .05 Means		1.8	0.09	NS	NS	NS

Table 3. Effect of rate of planting on the plant cane yield of four varieties of sugarcane on a Commerce soil on the St. Gabriel Research Station, 1992.

Variety of cane	Rate of planting	Plant cane yield	Stalk weight	Normal juice		Sugar yield
				Brix	Sucrose	
	stalks	T/A	lbs.	%	%	lbs/A
CP 65-357	2	28.5	2.43	19.5	16.6	6938
	3	30.4	2.44	19.4	16.5	7383
	4	31.4	2.44	19.0	16.1	7367
CP 72-370	2	27.3	2.17	17.8	15.0	5915
	3	27.5	2.21	17.7	14.9	5893
	4	29.6	2.41	17.8	14.9	6358
CP 74-383	2	27.2	2.37	18.1	15.3	6038
	3	27.1	2.51	17.8	15.0	5875
	4	29.2	2.33	17.8	15.3	6470
LCP 82-089	2	25.4	2.21	18.8	16.0	5918
	3	26.8	2.11	18.7	16.0	6242
	4	28.7	2.16	19.0	16.2	6686
LSD .05 Treatments		3.1	0.26	0.5	0.5	802
		Mean rate effect				
	2	27.1	2.30	18.6	15.7	6202
	3	28.0	2.32	18.4	15.6	6348
	4	29.6	2.34	18.4	15.6	6720
LSD .05 Means		1.5	NS	NS	NS	407

Table 4. Effect of rate of planting on the first stubble cane yield of four varieties of sugarcane on a Commerce soil on the St. Gabriel Research Station, 1992.

Variety of cane	Rate of planting	Stubble cane yield	Stalk weight	Normal juice		Sugar yield
				Brix	Sucrose	
	stalks	T/A	lbs.	%	%	lbs/A
CP 65-357	2	25.0	1.90	19.0	16.0	5826
	3	26.4	1.94	19.1	16.1	6211
	4	27.2	1.96	19.3	16.4	6537
CP 72-370	2	26.8	1.92	18.1	15.0	5812
	3	26.3	1.85	18.4	15.4	5894
	4	25.4	1.73	18.3	15.1	5569
CP 74-383	2	27.7	2.01	17.9	15.0	6011
	3	28.9	2.10	18.0	15.0	6257
	4	29.2	2.04	17.2	14.2	5940
LSD .05 Treatments		2.8	0.19	0.7	0.7	751
		Mean rate effect				
	2	26.5	1.94	18.3	15.4	5883
	3	27.2	1.96	18.5	15.5	6121
	4	27.3	1.91	18.3	15.3	6015
LSD .05 Means		NS	NS	NS	NS	NS

Table 5. Effect of depth of seed cover and shaving on the plant cane yield of two varieties of sugarcane on a Commerce soil on the St. Gabriel Research Station, 1992.

Seed cover depth	Shave treat.	Plant cane yield	Stalk weight	Normal juice		Sugar yield
				Brix	Sucrose	
in.		T/A	lbs.	%	%	lbs/A
				CP 72-370		
3-4	Check	23.1	2.20	17.4	14.8	4898
	Shave	23.7	2.39	17.5	14.9	5078
5-6	Check	25.7	2.24	17.7	14.9	5521
	Shave	22.7	2.10	17.8	14.9	4862
7-8	Check	20.5	2.14	17.7	14.8	4380
	Shave	22.2	2.16	17.5	14.6	4699
				LCP 82-089		
3-4	Check	23.2	2.08	19.2	16.2	5537
	Shave	24.2	2.40	18.7	15.9	5606
5-6	Check	20.9	2.09	18.8	15.9	4824
	Shave	21.4	2.26	18.7	15.8	4929
7-8	Check	21.9	2.19	18.7	15.8	5041
	Shave	22.2	2.01	18.8	15.8	5093
LSD .05 Treatments		3.1	0.22	0.6	0.7	671
				Mean effect		
3-4		23.6	2.27	18.2	15.5	5280
5-6		22.7	2.17	18.3	15.4	5034
7-8		21.8	2.13	18.2	15.3	4803
	Check	22.6	2.16	18.3	15.4	5033
	Shave	22.8	2.22	18.2	15.3	5045
LSD .05 Depth Means		1.5	0.11	NS	NS	336
LSD .05 Shave Means		NS	NS	NS	NS	NS

Table 6. Effect of depth of seed cover and shaving on the first stubble cane yield of two varieties of sugarcane on a Commerce soil on the St. Gabriel Research Station, 1992.

Seed cover depth	Shave treat.	Stubble cane yield	Stalk weight	Normal juice		Sugar yield
				Brix	Sucrose	
in.		T/A	lbs.	%	%	lbs/A
			CP 65-357			
3-4	Check	28.6	1.95	18.3	15.0	6200
	Shave	27.3	1.92	19.0	15.8	6266
5-6	Check	26.0	1.97	18.4	15.0	5647
	Shave	27.0	1.95	18.2	14.9	5827
7-8	Check	24.9	1.97	18.3	15.1	5447
	Shave	26.0	1.94	17.8	14.8	5552
			CP 70-321			
3-4	Check	25.3	2.03	17.2	14.5	5261
	Shave	24.7	2.07	18.5	15.2	5410
5-6	Check	27.7	2.14	17.9	15.1	6063
	Shave	27.4	2.06	18.0	15.3	6083
7-8	Check	23.3	2.15	16.7	13.8	4569
	Shave	24.8	2.07	18.2	15.3	5508
LSD .05 Treatments		3.1	0.25	.08	0.7	655
			Mean effect			
3-4		26.5	1.99	18.2	15.1	5784
5-6		27.1	2.03	18.1	15.1	5905
7-8		24.7	2.03	17.7	14.8	5269
	Check	26.0	2.04	17.8	14.8	5531
	Shave	26.0	2.00	18.3	15.2	5774
LSD .05 Depth Means		1.6	NS	0.4	NS	328
LSD .05 Shave Means		NS	NS	0.3	0.3	NS

Table 7. Effect of date of harvesting plant cane on yield of the subsequent stubble cane of four varieties on Commerce soil on the St. Gabriel Research Station, 1992.

Variety of cane	Date of plant cane harvest	Stubble cane yield	Stalk weight	Normal juice		Sugar yield
				Brix	Sucrose	
	1991	T/A	lbs.	%	%	lbs/A
CP 70-321	Sept. 4	26.1	2.00	18.7	16.1	6114
	Oct. 1	24.3	2.05	18.7	16.0	5671
	Nov. 1	31.0	2.00	18.9	16.1	7274
	Dec. 1	33.5	2.12	18.9	16.4	8033
CP 72-370	Sept. 4	23.0	1.96	18.1	14.8	4899
	Oct. 1	21.8	1.97	18.8	15.9	5033
	Nov. 1	26.5	2.01	19.1	16.2	6275
	Dec. 1	29.9	1.95	18.4	15.6	6754
CP 79-318	Sept. 4	26.0	2.56	17.9	15.2	5699
	Oct. 1	26.4	2.57	18.4	15.7	6013
	Nov. 1	30.3	2.40	18.3	15.4	6789
	Dec. 1	32.4	2.44	18.5	15.8	7436
LCP 82-089	Sept. 4	21.9	1.68	19.6	16.5	5313
	Oct. 1	23.4	1.89	19.7	16.8	5758
	Nov. 1	24.3	1.75	19.5	16.6	5927
	Dec. 1	23.3	1.90	19.8	16.9	5814
LSD .05 Treatments		3.0	0.27	0.5	0.5	766
				Mean date effect		
	Sept. 4	24.3	2.05	18.6	15.6	5506
	Oct. 1	24.0	2.12	18.9	16.1	5619
	Nov. 1	28.0	2.04	18.9	16.1	6566
	Dec. 1	29.8	2.10	18.9	16.2	7007
LSD .05 Means		1.5	NS	NS	0.2	384

Table 8. Effect of date of harvest on the yield of four varieties of plant cane on Commerce soil on the St. Gabriel Research Station, 1992.

Variety of cane	Date of plant cane harvest	Plant cane yield	Stalk		Normal juice		Sugar yield
			No.	Wt.	Brix	Sucrose	
	1992	T/A	1000/A	lbs.	%	%	lbs/A
CP 70-321	Oct. 1	30.2	31.5	2.24	16.2	12.6	5291
	Nov. 10	35.2	30.0	2.33	17.8	15.5	7885
	Dec. 1	33.0	30.8	2.49	18.1	15.5	7416
LCP 82-089	Oct. 1	29.2	29.3	2.05	16.8	12.3	5005
	Nov. 10	38.9	29.8	1.98	17.3	14.5	8090
	Dec. 1	32.1	29.6	2.22	18.3	15.5	7191
LHO 83-153	Oct. 1	31.3	35.5	1.82	15.5	11.0	4639
	Nov. 10	38.1	30.0	2.13	17.4	15.0	8229
	Dec. 1	38.4	32.8	2.16	17.7	15.0	8300
LCP 85-384	Oct. 1	32.9	40.2	2.04	16.0	11.7	5285
	Nov. 10	44.4	34.3	2.04	18.0	15.4	9890
	Dec. 1	34.3	38.5	1.91	18.9	15.9	7933
LSD .05 Treatments		3.3	3.6	0.25	0.7	0.7	770
		Mean date effect					
	Oct. 1	30.9	34.1	2.04	16.2	11.9	5055
	Nov. 10	39.2	31.0	2.12	17.7	15.1	8524
	Dec. 1	34.5	32.9	2.19	18.2	15.5	7710
LSD .05 Means		1.6	1.8	0.13	0.3	0.3	386

The plant cane of each variety was harvested on four dates and the yields were measured on the last three harvest dates in 1992.

Table 9. Mean effects of fall applied fertilizer, Furadan and soil cover on first stubble average yield of CP 72-370 and CP 74-383 on a Commerce soil on the St. Gabriel Research Station, 1992.

Fall Fertilizer $N-P_2O_5-K_2O$	Furadan	Soil cover	Stubble cane yield	Stalk		Normal juice		Sugar yield
				No.	Wt.	Brix	Sucrose	
lbs/A			T/A	1000/A	lbs.	%	%	lbs/A
0-0-0			27.9	34.2	1.92	17.9	14.8	5954
90-90-90			29.7	29.1	1.91	17.7	14.7	6234
	Check		28.4	30.2	1.93	17.7	14.7	5986
	Furadan		29.2	33.0	1.89	17.8	14.8	6205
		Check	28.2	31.5	1.87	17.8	14.7	5918
		Cover	29.4	31.7	1.95	17.8	14.8	6272
LSD .05 Means			1.0	3.3	NS	0.2	0.2	235

The fall fertilizer treatment was applied in the planting furrows and a 120-0-80 fertilizer was applied to all plots in the spring. The Furadan treatment at 10 lbs/A was applied in the fall and spring. The soil cover on cane stubbles was applied after harvesting plant cane in 1991.

Table 10. Effect of stubble protection after two harvest dates of two cane varieties on the yield of the subsequent stubble crop on the St. Gabriel Research Station, 1992.

Date of plant cane harvest	Stubble protection treatment	Stubble yield 1992	Stalk		Normal juice		Sugar yield
			No.	Wt.	Brix	Sucrose	
1991	1991	T/A	1000/A	lbs.	%	%	lbs/A
		CP 72-370					
Oct. 1	Check	19.0	25.5	1.60	17.1	13.8	3733
	Cover 1	21.6	26.1	1.89	18.5	14.9	4620
	Cover 1 shave	20.7	29.3	1.72	16.7	13.2	3851
	Cover 2 shave	17.1	25.3	1.61	16.9	13.3	3227
Dec. 1	Check	22.6	33.6	1.78	17.7	14.4	4668
	Cover 1	25.1	24.5	2.14	18.0	14.6	5273
	Cover 1 shave	25.2	26.4	2.09	17.6	14.6	5274
	Cover 2 shave	27.0	31.1	1.91	18.1	14.8	5763
		CP 74-383					
Oct. 1	Check	23.8	27.5	1.68	17.1	13.8	4671
	Cover 1	27.3	31.2	1.89	17.8	14.6	5759
	Cover 1 shave	24.6	29.8	1.72	17.1	13.4	4677
	Cover 2 shave	19.8	28.4	1.78	16.1	12.9	3563
Dec. 1	Check	32.5	38.3	1.80	17.1	13.9	6412
	Cover 1	34.2	31.5	1.98	17.6	14.1	6876
	Cover 1 shave	33.6	33.6	1.67	17.0	13.7	6571
	Cover 2 shave	30.7	35.3	1.65	17.2	13.9	6054
LSD .05 Treatments		3.7	6.7	0.30	0.7	0.6	765
		Mean Cover Effect					
	Check	24.5	31.2	1.72	17.3	14.0	4871
	Cover 1	27.0	28.3	1.97	18.0	14.6	5632
	Cover 1 shave	26.0	29.8	1.80	17.1	13.7	5093
	Cover 2 shave	23.7	30.0	1.74	17.1	13.7	4652
LSD .05 Means		1.8	NS	0.15	0.3	0.3	383

Cane stubbles were covered after harvesting plant cane. Cover 1 was applied immediately after each harvest date and Cover 2 was applied at the end of the harvest season in December, 1991.

Table 11. Effect of a stubble digger and Lilliston cultivator on stubble yield of four varieties on Commerce soil on the St. Gabriel Research Station, 1992.

Cane Variety	Treatment	Stubble cane yield	Stalk		Normal juice		Sugar yield
			No.	Wt.	Brix	Sucrose	
		T/A	1000/A	lbs.	%	%	lbs/A
CP 65-357	Check	28.4	27.1	1.95	18.2	15.6	6252
	Shaver	27.8	25.6	1.93	18.8	15.6	6315
	Digger	33.1	32.5	1.89	18.9	15.8	7610
	Lilliston	32.9	27.3	2.11	19.1	16.0	7678
CP 70-321	Check	28.3	24.1	2.10	18.4	15.7	6464
	Shaver	27.6	25.8	2.16	18.0	15.3	6148
	Digger	30.3	28.4	2.32	17.9	15.2	6685
	Lilliston	30.1	25.8	2.04	18.0	15.4	6724
CP 72-370	Check	30.2	24.6	2.22	18.1	15.2	6637
	Shaver	29.9	26.5	2.17	18.0	15.0	6466
	Digger	28.7	25.0	1.73	17.1	14.2	5791
	Lilliston	27.8	25.1	2.04	17.6	14.8	5907
CP 74-383	Check	31.7	27.6	1.96	16.7	13.9	6249
	Shaver	27.0	27.3	1.92	16.8	14.2	5405
	Digger	31.2	31.3	1.96	17.1	14.5	6476
	Lilliston	32.5	32.9	1.87	17.4	14.7	6835
LSD .05 Treatments		2.8	5.5	0.30	0.9	1.1	725
		Mean Effect					
	Check	29.6	25.9	2.06	17.9	15.0	6400
	Shaver	28.1	26.3	2.05	17.9	15.0	6083
	Digger	30.8	29.3	1.98	17.8	14.9	6641
	Lilliston	30.8	27.8	2.01	18.0	15.2	6786
LSD .05 Means		1.4	2.8	0.15	NS	NS	362

Cane stubbles were shaved to ground level prior to applying the digger and Lilliston.

SOIL FERTILITY RESEARCH WITH SUGARCANE IN 1992

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in cooperation with
St. Gabriel and Iberia Research Stations and Cane Growers

SUMMARY:

Seven field experiments were conducted in 1992 on Research Stations and cane plantations to test the effects of rates of fertilization on the yield of sugarcane. In NPK tests on a Commerce soil, increases in cane yields were significant from the application of 60 lbs/A of N in first and second stubble cane, but increases from higher N rates were small. Yield increases from the application of phosphate and potash alone or in combination were not significant in each test. In a PKS test on a Coteau soil the cane and sugar yields of first stubble cane were significantly increased with K rates, but not with P and S rates.

In a test on rates of N fertilizer application on a Baldwin soil, cane yield increases were significant from 60 lbs/A of N and from 210 lbs/A over the 60 lbs/A rate. In another N test on a Commerce soil, the yields of second stubble cane from the application of 120, 180 and 240 lbs/A of N were similar and significantly higher than the check plot yield.

In a succession and fallow cane test on Commerce soil, first stubble cane yields were increased from a fall applied 15-45-45- NPK fertilizer and spring applied N and NPK rates in both types of cane. Higher fall rates did not improve cane yield.

OBJECTIVES:

This research was designed to provide information on soil fertility in an effort to help cane growers to produce maximum economic yields and to increase profitability in sugarcane production. This annual progress report is presented to provide the latest available data on certain practices and not as a final recommendation for growers to use all of these practices. Recommendations are based on several years of research data.

RESULTS AND DISCUSSION:

Seven field experiments were conducted in soil fertility in sugarcane in 1992. The winter temperatures prior to the 1992 crop were mild and severe freeze damage to cane stubbles did not occur in the experiments. However, cane yields were adversely affected by hurricane force winds in August and a killing freeze in November, 1992.

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Rates of N, P and K Fertilizers

Experiments were conducted to test rates of fertilizer application on the yield of first and second stubble cane on Commerce silt loam soil on the St. Gabriel Research Station. The treatments consisted of 60, 120, 180 and 240 lbs/A of nitrogen, 0 and 60 lbs/A of phosphate and 0, 80 and 160 lbs/A of potash.

The data obtained in first stubble cane are reported in Table 1. Each fertilizer treatment increased the cane and sugar yields over the check plot. The yield increase from 60 lbs/A of N was significant but increases from higher N rates were small. Yield increases from phosphate or potash alone were small, but the 240-80-160 treatment produced significantly more cane yield than the 240-0-0.

The data obtained in second stubble cane are reported in Table 2. Each fertilizer treatment increased the cane and sugar yields over the check plot yield. The yield increase from 60 lbs/A of N was significant, but increases from higher N rates were small. Yield increases from phosphate and potash alone or in combination were not significant. However, the 3.5 T/A yield increase from 180-60-80 over the 180-0-0 treatment was very close to significance. The cane yield in this second stubble test was relatively low and the experimental error was unusually high due to wind and freeze damage.

Rates of P, K and S Fertilizers

An experiment was conducted to test rates of, P, K and S fertilizers on yield of first stubble cane on a Coteau soil on Lemaire Farms in Iberia Parish. The rates consisted of 0, 30 and 60 lbs/A of phosphate 0, 50, 100 and 150 lbs/A of potash and 24 lbs/A of sulphur. The treatments were applied in April and 120 lbs/A rate of N was applied to all the plots except the check plot. The data obtained at harvest time are reported in Table 3. The yield increase from 120 lbs/A of N was not significant due to a large experimental error caused by hurricane damage in this test. However, the yields from about one-half of the NPK treatment combinations were significantly higher than the check plot yield. A factorial analysis of the data showed that the cane and sugar yields were significantly increased with the K rates, but not with the P rates. The yield increase from 24 lbs/A of sulphur was small.

Rates of N Fertilizer

Experiments were conducted to test rates of nitrogen fertilizer on the yield of sugarcane at two outfield locations. One test consisted of 30 lbs/A increment rates ranging from 0 to 240 lbs/A of N. It was on a Baldwin soil on Sterling Plantation in St. Mary Parish. The data obtained at harvest time are reported in Table 4. The yield increase from 60 lbs/A of N was significant. Also, the yield increase from 210 lbs/A of N over the 60 lbs/A rate was significant. The percent sucrose was not affected by the N rates and 210 lbs/A rate produced the highest sugar yield per acre.

Another experiment was continued to test nitrogen fertilizer rates in second stubble cane on a Commerce silt loam soil on Jerry Woods Welcome Farms in St. James Parish. The rates

of N tested were 0, 60, 120, 180 and 240 lbs/A. The data obtained at harvest time are reported in Table 5. The yield increase from the 60 lbs/A N rate was not significant. The cane and sugar yields from the 120, 180 and 240 N rates were similar and significantly higher than the check plot yield. The 240 rate produced the highest percent sucrose and sugar yield per acre.

Fertilizer Rates in Fallow and Succession Cane

An experiment was initiated to test the effects of NPK fertilizer rates applied in the fall and spring in fallow and succession plated cane. The fallow cane was planted after a fallow year and the succession cane was planted immediately after harvesting a cane crop without a fallow year in 1990. The fall applied NPK rates tested were 0-0-0, 15-45-45, 45-45-45 and 90-90-90. Spring applied rates of 120-0-0 and 120-40-80 were tested with each fall rate. Also, Furadan at 10 lbs/A applied in the fall and spring was tested in the succession cane. The fall treatments were applied in the planting furrows in 1990 and spring treatments were applied in the off-bar furrows in 1991 and 1992.

The data obtained in first stubble cane from fallow planted cane are shown in Table 6. The cane yields were increased from the fall applied 15-45-45 with N and NPK applied in the spring. Higher fall rates did not improve yields. Cane yields were increased from the spring applied 120-0-0 and 120-40-80 where no fall fertilizer was applied. The average difference in yield between the spring rates was small.

The data obtained in first stubble of succession planted cane are reported in Table 7. The cane yield was increased from the fall applied 15-45-45 when only N was applied in the spring. The cane yields were increased from the spring applied 120-0-0 over the check plot and from the 120-40-80 over the 120-0-0 where no fall fertilizer was applied. As an average of the fall applied rates, the cane yields were increased from the spring applied 120-40-80 over the 120-0-0. Furadan did not increase the cane yield this year.

Table 1. Effect of rate of fertilizer application on the yield and yield components of first stubble cane on a Commerce silt loam soil on St. Gabriel Research Station, 1992.

Fertilizer applied $N\text{-}P_2O_5\text{-}K_2O$	Stubble cane yield	Stalk weight	Normal juice		Sugar yield
			Brix	Sucrose	
lbs/A	T/A	lbs.	%	%	lbs/A
0-0-0	11.5	1.61	19.3	16.2	2730
60-0-0	26.6	1.96	19.2	16.1	6284
60-60-0	24.5	2.04	19.3	16.3	5833
60-0-80	26.0	2.00	19.5	16.2	6173
60-60-80	24.8	1.98	19.5	16.5	5980
120-0-0	27.8	1.98	19.1	16.0	6514
180-0-0	28.0	1.92	19.8	16.5	6809
180-60-0	30.1	2.02	19.4	16.2	7156
180-0-80	30.1	2.09	19.4	16.3	7152
180-60-80	30.4	2.02	19.2	16.0	7106
240-0-0	25.7	1.94	20.1	16.9	6381
240-80-160	32.6	2.18	19.3	16.2	7704
LSD .05	2.9	0.24	0.6	0.6	912

The experiment was conducted with first stubble cane of Variety CP 65-357 and the cane was fertilized in April and harvested in November, 1992.

Table 2. Effect of rate of fertilizer application on the yield and yield components of second stubble cane on a Commerce silt loam soil on St. Gabriel Research Station, 1992.

Fertilizer applied $N-P_2O_5-K_2O$	Stubble cane yield	Stalk		Normal juice		Sugar yield
		No.	Wt.	Brix	Sucrose	
lbs/A	T/A	1000/A	lbs.	%	%	lbs/A
0-0-0	7.5	17.1	1.38	16.6	13.6	1454
60-0-0	16.9	25.8	1.45	17.1	14.1	3394
60-60-0	18.1	26.1	1.65	16.6	13.3	3390
60-0-80	18.0	28.2	1.60	16.3	13.2	3385
60-60-80	18.1	27.8	1.69	16.4	13.4	3410
120-0-0	16.8	27.6	1.54	16.3	12.6	2991
180-0-0	18.0	31.0	1.56	16.4	12.9	3261
180-60-0	17.9	29.0	1.62	16.5	13.1	3303
180-0-80	18.3	28.9	1.66	16.3	13.3	3421
180-60-80	21.5	32.4	1.69	16.5	13.2	3992
240-0-0	18.2	28.3	1.70	16.9	13.7	3531
240-0-160	20.7	30.2	1.74	16.3	13.1	3825
LSD .05	3.6	5.1	0.33	NS	0.9	805

The experiment was conducted with second stubble cane of Variety CP 65-357 and the cane was fertilized in April and harvested in October, 1992.

Table 3. Effect of rate of fertilizer application on the yield of first stubble cane on Coteau silt loam on Lemaire Farms in Iberia Parish, 1992.

Fertilizer applied $N-P_2O_5-K_2O$	Stubble cane yield	Stalk weight	Normal juice		Sugar yield
			Brix	Sucrose	
lbs/A	T/A	lbs.	%	%	lbs/A
0-0-0	22.6	2.08	17.7	14.9	4800
120-0-0	27.7	2.21	17.8	15.1	6056
120-0-50	28.8	2.32	17.5	14.7	6104
120-0-100	29.8	2.55	17.9	15.1	6506
120-0-150	26.7	2.46	17.7	15.1	5787
120-30-0	25.3	2.35	18.2	15.4	5635
120-30-50	29.9	2.32	17.9	15.1	6537
120-30-100	28.3	2.45	18.0	15.4	6317
120-30-150	30.8	2.51	17.7	15.0	6650
120-60-0	26.3	2.33	17.7	15.0	5696
120-60-50	28.9	2.45	17.4	14.6	6079
120-60-100	30.9	2.21	17.4	14.6	6457
120-60-150	26.6	2.72	17.6	14.8	5673
120-60-150 + 24S	30.6	2.65	17.7	15.0	6647
LSD .05	6.0	0.29	0.8	0.9	1317

A PXK factorial analysis of the data showed that the cane and sugar yields were significantly increased with the K rates, but not with the P rates.

Table 4. Effect of rate of nitrogen fertilizer application on the yield of first stubble cane on a Baldwin soil on Sterling Plantation in St. Mary Parish, 1992.

Fertilizer applied $N-P_2O_5-K_2O$	Stubble cane yield	Stalk weight	Normal juice		Sugar yield
			Brix	Sucrose	
lbs/A	T/A	lbs.	%	%	lbs/A
0-0-0	8.5	1.22	19.0	16.4	2013
30-0-0	9.4	1.10	19.5	16.6	2285
60-0-0	15.7	1.18	19.4	16.5	3769
90-0-0	15.8	1.40	19.2	16.2	3707
120-0-0	16.5	1.40	19.6	16.5	3967
150-0-0	15.0	1.30	19.2	16.5	3630
180-0-0	17.8	1.36	19.4	16.5	4296
210-0-0	21.2	1.53	19.3	16.4	5062
240-0-0	17.5	1.49	18.7	15.7	3994
LSD .05	3.5	0.24	NS	NS	814

The experiment was conducted in Variety CP65-357 and the cane was fertilized in April and harvested in December, 1992.

Table 5. Effect of rate of nitrogen fertilizer application on the yield and yield components of second stubble cane on a Commerce silt loam on Jerry Woods Farms in St. James Parish, 1992.

Fertilizer applied $N-P_2O_5-K_2O$	Stubble cane yield	Stalk weight	Normal juice		Sugar yield
			Brix	Sucrose	
lbs/A	T/A	lbs.	%	%	lbs/A
0-0-0	19.3	1.90	16.7	13.3	3631
60-0-0	22.2	2.01	17.3	13.6	4287
120-0-0	25.9	1.87	17.0	13.8	5065
180-0-0	28.2	1.86	17.1	13.7	5500
240-0-0	27.9	1.94	17.2	14.0	5582
LSD .05	5.2	NS	NS	0.7	1093

The experiment was conducted with variety CP 72-370 and the cane was fertilized in May and harvested in October, 1992.

Table 6. Effect of rate of fall and spring applied fertilizers on yield of first stubble cane planted after a fallow year on a Commerce silt loam soil on the St. Gabriel Research Station, 1992.

Fertilizer Applied $N-P_2O_5-K_2O$		Stubble cane	Stalk	Normal juice		Sugar
Fall	Spring	yield	weight	Brix	Sucrose	yield
lbs/A	lbs/A	T/A	lbs.	%	%	lbs/A
			Fallow Planted Cane			
0-0-0	0-0-0	22.9	2.03	17.2	14.5	4762
	120-0-0	30.8	2.22	16.7	14.0	6163
	120-40-80	31.1	2.14	16.0	13.3	5832
15-45-45	120-0-0	34.9	2.14	16.4	13.8	6812
	120-40-80	37.6	2.17	16.6	13.9	7459
45-45-45	120-0-0	32.9	2.34	16.7	14.0	6563
	120-40-80	38.0	2.22	16.6	13.8	7378
90-90-90	120-0-0	30.9	2.47	16.2	13.5	5903
	120-40-80	28.9	2.45	16.1	13.5	5546
LSD .05 Treatments		3.3	0.34	0.3	0.3	845
			Mean Effect			
0-0-0		31.0	2.18	16.4	13.7	5998
15-45-45		36.3	2.15	16.5	13.8	7136
45-45-45		35.4	2.28	16.7	13.9	6971
90-90-90		29.9	2.46	16.2	13.5	5724
	120-0-0	32.4	2.29	16.5	13.8	6360
	120-40-80	33.9	2.24	16.3	13.6	6554
LSD .05 Fall means		2.3	0.24	NS	NS	599
LSD .05 Spring means		NS	NS	NS	NS	NS

Variety CP 70-321 was planted after a fallow year. The fall fertilizer was applied in planting furrows and the spring fertilizer was applied in off-bar furrows.

Table 7. Effect of rate of fall and spring applied fertilizers on yield of first stubble cane planted in succession on a Commerce silt loam soil on the St. Gabriel Station, 1992.

Fertilizer Applied $N-P_2O_5-K_2O$		Stubble cane	Stalk	Normal juice		Sugar
Fall	Spring	yield	weight	Brix	Sucrose	yield
lbs/A	lbs/A	T/A	lbs.	%	%	lbs/A
		Succession planted cane				
0-0-0	0-0-0	23.3	2.43	16.8	14.4	4786
	120-0-0	30.2	2.22	16.5	13.8	5909
	120-40-80	34.6	2.26	17.2	14.3	7056
	120-40-80 + F	33.4	2.34	16.3	13.6	6416
15-45-45	120-0-0	35.7	2.17	17.5	14.8	7553
	120-40-80	34.5	2.11	17.4	14.9	7406
	120-40-80 + F	29.9	2.48	17.0	14.3	6139
45-45-45	120-0-0	27.9	2.33	17.0	14.3	5744
	120-40-80	32.3	2.25	17.8	15.1	7022
	120-40-80 + F	30.5	2.12	17.5	14.9	6549
90-90-90	120-0-0	28.6	2.26	17.0	14.5	5964
	120-40-80	30.5	2.24	17.3	14.7	6416
	120-40-80 + F	30.9	2.24	17.1	14.4	6383
LSD .05 Treatment		3.0	0.23	0.8	0.8	671
		Mean Effect				
0-0-0		32.7	2.27	16.6	13.9	6460
15-45-45		33.4	2.25	17.3	14.7	7032
45-45-45		30.3	2.23	17.5	14.8	6438
90-90-90		30.0	2.25	17.1	14.5	6254
	120-0-0	30.6	2.25	17.0	14.4	6372
	120-40-80	33.0	2.22	17.4	14.7	6975
	120-40-80 + F	31.2	2.30	17.0	14.3	6293
LSD .05 Fall means		1.8	NS	0.5	0.5	388
LSD .05 Spring means		1.5	NS	0.4	0.4	336

Variety CP 70-321 was planted in succession following a stubble crop. The fall fertilizer was applied in planting furrows and spring fertilizer was applied in off-bar furrows.

F = Furadan at 10 lbs/A applied in fall and spring.

KENAF AND SUGARCANE RESEARCH ON FIBER PRODUCTION IN 1992

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in cooperation with
St. Gabriel Research Station

SUMMARY:

Experiments were conducted in 1992 to compare fiber production in Kenaf and sugarcane. In Kenaf, varieties EV41, EV71, Cubana and Tainung were tested with 2- and 3-drill methods of planting. The Tainung variety produced more total dry fiber (11.4 T/A) than EV41 (8.5 T/A) and Cubano (8.8 T/A). There were no differences in yields due to number of drills planted on cane rows six feet wide. In sugarcane, a wild cane type variety L79-1002 was tested with 0-0-0, 160-0-0 and 160-60-120 fertilizer treatments. The 160-60-120 produced the highest cane yield (47.7 T/A) which contained 21.7% fiber and 10.4 T/A of dry fiber. In addition to fiber, the cane produced 6.4% sucrose and 3355 lbs/A of sugar. The total fiber production in Kenaf and cane was similar, but the type of fiber produced was different. Kenaf produced bast and core fibers and cane produced typical bagasse fiber.

OBJECTIVES:

The research was initiated to evaluate the potential of growing Kenaf and sugarcane as alternate crops for the production of fiber.

RESULTS AND DISCUSSION:

The following experiments were located on a Commerce soil on the St. Gabriel Research Station.

Kenaf Fiber

A Kenaf experiment was conducted to test the effects of four varieties and two methods of planting on fiber production.

The varieties planted in the test were EV41, EV71, Cubano and Tainung. The EV41 and Tainung varieties were planted in two drills, 22 inches apart and EV71 and Cubano was planted in two drills and also in three drills, 11 inches apart on cane rows six feet wide. The seeding rates were 80,000 seeds per acre in two drills and 120,000 seeds per acre in three drills. The drill spacings were chosen to accommodate sugarcane harvesting equipment. A 120-0-80 fertilizer was bedded in the rows prior to planting and the crop was side-dressed with 90 lbs/A

of nitrogen. Prowl was applied as a pre-emergence herbicide to control weeds. The plots were planted on April 14 and the Kenaf was cut with a sugarcane harvester in November, 1992. All the stalks on each plot were weighed in the field.

The stalk population, weight, and diameter were measured at harvest time. Also, the yields of green stalks and leaves and dry stalk fiber were measured at harvest time. The percent bast and core fibers in the stalks were determined by crushing 10-stalk samples in a sugarcane laboratory mill and separating the fibers by hand. The percent and yield of bast and core fibers were calculated for each variety.

The data obtained on the yield components of each variety are reported in Table 1. The stalk populations were similar in EV71 and Cubano, but lower in EV41 and higher in Tainung. The three-drill planting increased the stalk population over two-drills, but did not affect the stalk weight, diameter and yield. The Tainung variety produced more green stalk yield than the EV41 variety.

The data obtained on the yield of stalk fiber are reported in Table 2. The percent fiber in the green stalks was similar among varieties averaging 39.3%. The dry fiber in the Cubano variety was higher in percent bast fiber (38.9%) and lower in percent core fiber (61.1%) than in EV41. The Tainung variety produced more total dry fiber (11.4 T/A) than EV41 and Cubano. The three-drill planting did not increase fiber yield over the 2-drill.

Sugarcane Fiber and Sugar

An experiment was conducted to test the effects of fertilizer rates on the fiber and sugar production of a wild cane variety L79-1002. This cane variety is a progeny from crossing CP52-68 X Tianan 96. CP52-68 was a major variety grown in Louisiana in the 1960's and Tianan 96 is a wild type of sugarcane which grows without cultivation in Argentina. Variety L79-1002 is a high fiber cane with a high stalk population, small stalk diameter and high stubbling ability.

A plant cane crop of L79-1002 was grown on replicated plots in 1992. The fertilizer treatments tested consisted of 0-0-0, 160-0-0 and 160-60-120 lbs/A of NPK. The treatments were applied in the spring and normal cane cultural practices were used during the growing season. The cane was cut with a cane harvester and weighed in November to measure the fiber, cane and sugar yields. The stalk population and weight were determined at harvest time. A 20-stalk sample from each plot was used to measure the percent fiber and sucrose in the laboratory.

The data obtained in the test are reported in Table 3. The stalk population was very high and the average stalk weight was relatively low on each plot as compared to a standard cane variety. The 160-60-120 fertilizer increased the cane and sugar yields, but dcreased the percent stalk fiber over the check plot. The highest yields produced were 47.7 T/A of cane stalks containing 21.7% fiber and 10.4 T/A of dry fiber. Also, the stalks contained 6.4% sucrose and produced 3355 pounds of sugar per acre. The sucrose expressed as percent of stalk weight was relatively low.

Kenaf and Cane Comparison

The highest yields of total dry fiber measured in Kenaf (11.4 T/A) and sugarcane (10.4 T/A) were similar, but the types of fiber produced were different. Kenaf contained about one-third bast fiber and two-thirds core fiber. Bast fiber is long and strong individual fibers and core fiber is soft and spongy fiber contained in the inter-core of the stalks. The cane fiber was typical bagasse fiber used to burn and generate power in sugar mills. However, in addition to fiber, the cane produced a sugar yield (3355 lbs/A) equal to about one-half the yield of commercial varieties.

The Kenaf and cane were considerably taller than the maximum topping height of a cane harvester and the yields reported were lower than the yields actually produced in the field.

Table 1. Effect of varieties and number of drills on the yield components of kenaf on a Commerce soil in 1992.

Kenaf Variety	Number of drills*	Stalk			Stalk Yield T/A
		No. 1000/A	Weight lbs.	Diameter cm	
EV41	2	41.4	1.62	2.45	21.0
EV71	2	52.1	1.23	2.05	24.3
EV71	3	70.4	1.24	2.11	24.2
Cubano	2	54.9	1.31	2.19	23.5
Cubano	3	72.8	1.19	2.13	25.9
Tainung	2	68.5	1.25	2.08	28.6
LSD .05		6.8	NS	0.38	5.2

*Number of drills on rows six feet wide.

Table 2. Effect of varieties and number of drills on the fiber yield of kenaf on a Commerce soil in 1992.

Kenaf Variety	Number of drills	Stalk Fiber %	Dry Fiber Yield				
			Bast Fiber		Core Fiber		Total T/A
			%	T/A	%	T/A	
EV41	2	40.5	31.8	2.7	68.2	5.8	8.5
EV71	2	41.1	33.9	3.4	66.1	6.6	10.0
EV71	3	39.6	36.1	3.4	63.9	6.2	9.6
Cubano	2	37.4	38.9	3.4	61.1	5.4	8.8
Cubano	3	37.4	35.5	3.4	64.5	6.2	9.7
Tainung	2	39.8	32.3	3.7	67.7	7.7	11.4
LSD .05		NS	3.2	0.8	3.2	1.8	2.5

Table 3. Effect of fertilizers on the fiber and sugar yields of a wild cane variety L79-1002 on a Commerce soil in 1992.

Fertilizer N-P-K lbs/A	Stalk		Dry Stalk Fiber Yield		Cane Yield T/A	Stalk Sucrose %	Sugar Yield lbs/A
	No. 1000/A	Wt. lbs.	%	T/A			
0-0-0	90.3	0.89	24.7	9.9	40.2	6.0	2552
160-0-0	85.2	1.00	22.8	9.7	42.6	6.4	2974
160-60-120	95.4	1.00	21.7	10.4	47.7	6.4	3355
LSD .05		NS	1.9	NS	3.4	NS	762

Sucrose is expressed as percent of stalk weight. Variety L79-1002 is an F_1 progeny from crossing CP52-68 X Tianan 96 (a wild type cane from Argentina).

A SUMMARY OF THE DEPARTMENT OF AGRICULTURAL ECONOMICS AND AGRIBUSINESS RESEARCH PROGRAM IN SUGARCANE FOR 1992.

Arthur M. Heagler and Jason Johnson
Department of Agricultural Economics and Agribusiness

Enterprise cost and return projections for Louisiana sugarcane production processes have been published in the present format since 1981. However, the presentation has undergone considerable change in an effort to provide detailed and meaningful planning information to farmers, extension personnel, researchers, allied agricultural industry and others working in or with agriculture.

Detailed production sequences and associated costs for 1993 are presented for six activity sets, an overhead budget and projected revenues in The Department of Agricultural Economics and Agribusiness A.E.A. INFORMATION SERIES NOS. 109-115. The activities include fallow, seedbed preparation, cutting and planting seedcane, cultural regimes for plant care, first stubble and second stubble crops, harvesting sugarcane with one and two row harvesters with alternative hauling options and heat treatment to control RSD. All cost and revenue estimates are calculated on a per acre of land basis. This format offers each individual an opportunity to select those budgets that fit his "unique" situation and develop cost and return estimates reflecting his land and production activities.

Growers have alleviated most of the rotation disruption emanating from the late December freeze of 1989. A combination of succession planting coupled with a vigorous selection process that led to a reduction in the retention rate of first stubble for the 93 crop year were used to achieve this objective (Table 1). Projected planting costs will be higher than those experienced in 1992, reflecting the increased costs associated with succession planting and a substantial increase in fallow acres. Profit margins for 1993 are estimated to be substantially lower (Table 2).

Projections indicates land use for the 1993 crop will be close to that normally expected. However, productivity as well as profit margins per rotational acre will be down substantially. The situation in the following year should be similar if normal weather prevails. The cost of production inputs and services will continue to increase at moderate rates while product price will be stable or down marginally. Thus, projected per acre returns to management and risk, (identified in Table 2 as residual returns) are expected to decline.

A whole farm linear programming simulation model was updated and used to examine the impact of alternative rotations in sugarcane production. A third ratoon rotation and succession planting were examined as alternatives within the standard rotational sequence. The results of this economic analysis suggest that these production techniques do have merit in improving production efficiency as well as the financial position of sugarcane producers. Other areas are being evaluated for possible analysis to assess the sugarcane production opportunities in Southwest Louisiana.

Research was completed which attempted to identify, for individual farms, technical and allocational economic efficiency cost frontiers for fertilizer, labor, chemicals, and machinery repairs. Six years of data from 105 sugarcane farms were used to find that both technical and allocational efficiency improved during the study period. Deviations from the technical frontier was low (20%), however, deviation from the allocational frontier was high (80%).

Heagler, A. M., and Jason Johnson. Projected Costs and Returns - Sugarcane, Louisiana 1993. AEA Information Series No. 103, January 1992. Dept. of Ag. Eco. and Agribus., LAES, LSU Agricultural Center, Baton Rouge, Louisiana.

Heagler, A. M., D. C. Huffman and K. W. Paxton. Crop and Livestock Cost Estimates for 1991. Louisiana Rural Economist, Vol. 53, No. 1, Dept. of Ag. Eco. and Agribus., LSU, Baton Rouge, Louisiana, February 1991.

Kanjilal, B., H. O. Zapata and A. M. Heagler. Efficiency and Regional Comparative Advantage. Invited Paper, 1991 AAEA Annual Meeting, July 1991, Manhattan Kansas.

Johnson, Jason L., A. M. Heagler and H.O. Zapata. "The Economic Impact of Alternative Rotations in Sugarcane Production in Louisiana."Invited paper, 22nd Annual Meeting, American Society of Sugarcane Technologists, June 1992, St. Augustine, FL.

Heagler, Arthur M. "Implications of Changing Cultural Practices on Sugarcane Land Values." Invited Paper, Louisiana Realtors Land Institute Sixth Annual Conference, Baton Rouge, LA, May 22, 1992.

Table 1. Projected Output per Rotational Acre Estimates for Tenants and Owner Operators, Sugar Cane, Louisiana, 1993.

Item	Land Use %	Plant Cane Tenant	Plant Cane Owner/ Operator	1st Stubble Tenant	1st Stubble Owner/ Operator	2nd Stubble Tenant	2nd Stubble Owner/ Operator	Marketable Output per Rotational Acre
Land	100	5920	5920	4800	4800	4200	4200	
HRC								
Plant Cane[1/]	0.25	1480	1480	0	0	0	0	
1st Stubble	0.26	0	0	1248	1248	0	0	
2nd Stubble	0.24	0	0	0	0	1008	1008	
Amount for Seed[2/]	0.052	77	77	0	0	0	0	
Fallow	0.25							
Raw Sugar		1403	1403	1248	1248	1008	1008	
Mill	0.39	547	547	487	487	393	393	
Land Rent	0.122	171	0	152	0	123	0	
Grower's Share[3/]								
Tenant		685	0	609	0	492	0	1786
Owner/Operator		0	856	0	761	0	615	2232

HRC Harvested Rotational Cane

1/ 1 percent is succession planted.

2/ Comes out of plant cane

3/ Grower share is raw sugar less amount taken out for mill and rent.

Table 2. A Summary of Projected Costs and Returns per Rotational Acre of Land in Sugarcane, Tenant, All Regions, South Louisiana, 1993.[a/]

Production Area	Adjusted Yield Per Acre [b/]	Total Income [c/d/c/]	Total Direct Costs	Returns Above Direct Costs	Total Fixed Costs	Total Specified Costs	Returns Above Specified Costs	Overhead Costs	Residual Returns
	----lbs----	----------	----------	----------	----------	dollars ----------	----------	----------	----------
River Region									
Sandy Soils	17.86	421.24	204.48	216.76	54.84	259.32	161.92	48.23	113.69
Clay Soils	17.86	421.24	201.92	219.32	53.60	255.52	165.72	48.23	117.49
Teche Region									
Sandy Soils	17.86	421.24	217.84	203.40	54.21	272.05	149.19	48.23	100.96
Clay Soils	17.86	421.24	215.98	205.60	53.47	269.45	121.79	48.23	103.56

[a/] Computations based on a four year rotation consisting of 25 percent fallow/plant, 25 percent plant cane of which 6 percent is succession planted, 26 percent 1st stubble, and 24 percent 2nd stubble with one acre of plant cane given up for each five acres planted.

[b/] Reflects the raw sugar output to a tenant grower per rotational acre of land in sugarcane as specified in Table 1.

[c/] Molasses output assumed to be 2.9 gallons per cwt. or raw sugar

[d/] Prices for raw sugar and molasses estimated at 21.50/cwt. and $0.26/gal., respectively.

[e/] Includes the 1992 farm program Market Service Payment on raw sugar (1% of the loan price per output unit).

SUGARCANE ANALYSIS BY NEAR INFRARED TRANSMISSION SPECTROSCOPY

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Abstract:

Sugarcane quality determination in the sugarcane industry is essential for proper financial compensation for the producer. The traditional press method analysis, however, is both time consuming and labor intensive. An alternative method requiring considerably less time and money would be very helpful. In order to develop a safe, rapid and accurate method of analysis, near-infrared (NIR) transmission spectroscopy was investigated.

Near-infrared transmission spectroscopy was used to predict brix (total amount of soluble solids), pol (amount of dextro-rotary substances), fiber, moisture and theoretical recoverable sugar. The traditional press method was used for comparison. The experiments were performed at a sugar mill laboratory with field contaminated sugarcane.

None of the results with field contaminated sugarcane was acceptable. Neither changing the number of sample scans nor dividing the samples into low and high fiber and dirty samples improved the results.

Adoption of NIR transmittance in the sugarcane industry would require either a reduction in sample particle size or a more powerful instrument to analyze larger samples.

Introduction:

Near-infrared spectroscopy can be used in two ways. The first determines the NIR reflectance from a sample, the other measures the transmission through a sample. Research has been conducted to analyze sugarcane with NIR reflectance. The results, however, were never sufficiently reliable and the studies did not provide a basis for adoption of NIR reflectance spectroscopy in the sugar industry (Buma, 1991).

This study was based on preliminary research performed by Trebor Industries, Inc. in their laboratory in March 1991 which yielded promising results (Trebor, 1991). The Trebor-99[1] was tested in the quality analysis laboratory of a Louisiana sugar mill with field contaminated sugarcane. The traditional press method was used for comparison.

Objective:

To develop and evaluate a calibration to determine brix, pol, moisture content, fiber and theoretical recoverable sugar (TRS) in field contaminated sugarcane samples with a near-infrared transmittance spectroscope as compared to the standard press method.

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[1]Trade names are used in the paper solely to provide specific information. Mention of a trade name does not constitute a warranty of the product by the Louisiana Agricultural Experiment Station of the LSU Agricultural Center nor an endorsement of the product to the exclusion of other products not mentioned.

Materials and Methods:

Press Method

Before harvesting sugarcane, the leafs are burned. The sugarcane that is received at the factory is contaminated with ash residue and soil. The sample tower of the sugar mill at St. Martinville samples every load of sugarcane. The sample is then shredded and about 4 lbs is sent through a pipeline to the laboratory.

A 1000 gram sample is weighed with a triple-beam balance, pressed at 10.000 lb/sq.inch, weighed, dried and weighed again. The juice is taken to measure the pol, which indicates the net amount of dextro-rotary substances, and the brix, which indicates the total amount of soluble solids in the juice.

The press method of cane analysis provides values for the weight of the cane sample, brix percentage and pol percentage of expressed juice, weight of the pressed residue and the weight of the dried residue. With these values, it is then possible to calculate the juice purity, fiber, pol, moisture and sucrose percentage (Tanimoto, 1964, Buma, 1991). Farmers are paid on the basis of TRS (theoretical recoverable sugar) defined as follows.

$$TRS = (2.8\ P - 0.8\ B)(100 - 56.67\ F/(100 - F))$$

where, P = pol % in cane
B = brix % in cane
F = fiber % in cane

The TRS values are reliable to $\pm$ 4% for the samples coming into the laboratory (Clarke, 1991). Samples taken out of the load are sometimes not representative of the actual cane quality of the load.

In any one day, up to 300 samples are analyzed in the St. Martinville sugar mill laboratory which employs five people working 10 hours a day.

Near-infrared Transmission

The Trebor-99 uses twelve wavelengths located between 915 and 1050 nm. The instrument also measures sample temperature and air temperature within the instrument. Calibration requires at least 140 samples with known constituent values. The need for this large number of samples is attributed to the multiple linear regression mathematics used in the instrument. The prediction equation can be defined as:

$$\% \text{ Constituent} = K_0 + K_1OD_1 + K_2OD_2 + \ldots + K_{12}OD_{12} + K_{13}T_s + K_{14}T_a$$

where: OD_1 through OD_{12} are the optical properties as measured by the Trebor-99 for each sample
K_0 through K_{14} are the calibration constants determined via multiple linear regression analysis
T_s and T_a are the temperature of the sample and the air inside the instrument, respectively. These temperatures are reported in degrees Celsius divided by 100 (Trebor, 1986)

The first 150 measurements used in the calibration for brix, pol, fiber, moisture and TRS was made November 12, 1991. A 40 gram sub-sample of shredded sugarcane was taken from the main laboratory sample at the St. Martinville sugar mill and pressed. The sub-sample was bagged and the bag (4" x 10 ") was placed in the sample holder with 16 mm path length. The sample was inserted in the Trebor-99, scanned and the sample reading was taken. The values of the press method were incorporated and the Trebor calibration software calculated the calibrations for the five constituents.

The software also identified statistical outliers which were eliminated from the analysis in a process called tumbling. Experience indicates that approximately 4% of all samples are potential outliers (Trebor, 1986). In this experiment, the calibrations were developed with ten tumbles (6% of all samples removed).

On November 18, 1991, 59 measurements were taken and the samples were divided into four groups; samples with low, medium and high fiber content (as determined from the press method) and samples with a large quantity of soil. For each constituent, one calibration was made with the low and medium fiber content samples (total 36 samples) and one with the high and medium fiber content samples (total 32 samples). For TRS, a third calibration was made with the low and medium fiber content samples and 7 tumbles (29 samples).

A validation of these calibrations was made on November 22, 1991. The calibration constants were entered into the Trebor-99, thirty samples were analyzed and predictions were calculated for each of the constituents.

Results and Discussion:

Initial calibrations were made for brix, pol, fiber, moisture and TRS with 150 samples. Refined calibrations were developed by the same 150 samples and 10 tumbles (140 samples). The correlation coefficients (r) and standard deviations (σ) of the calibrations are presented in Table 1. The correlation coefficients ranged from 0.33 to 0.53 with 150 samples and from 0.38 to 0.56 with 140 samples and 10 tumbles.

Table 1. Near-infrared transmission calibration statistics for field contaminated sugarcane.

Constituent	Mean	150 samples		140 samples (10 tumbles)	
		r	σ	r	σ
Brix	14.4%	0.40	1.1	0.46	0.9
Pol	11.9%	0.33	1.3	0.37	1.1
Fiber	14.7%	0.53	2.2	0.56	1.5
Moisture	49.5%	0.36	3.1	0.45	2.6
TRS	211	0.37	56	0.46	44

An acceptable calibration has a correlation coefficient of at least 0.90 and a desirable calibration is one with a correlation coefficient of 0.95 and higher. The correlation coefficients for all the constituents were too low in this study.

All of the validations with field contaminated sugarcane were unacceptable. Neither increasing the number of scans per sample nor dividing the samples into low and high fiber and dirty samples improved the results.

One problem was that the instrument only read a portion of a small sample (40 grams) of field contaminated sugarcane. With clean sugarcane samples, scanning of larger samples would be possible. The sugarcane that was analyzed by the instrument was heterogeneous and was possibly different from the larger sample (1 kg) that was used for the press method.

The adoption of NIR transmittance in the sugarcane industry would necessitate the use of a more powerful instrument to scan larger samples or a reduction in sample particle size.

References:

Buma, J.G.C. 1991. Sugarcane analysis using near-infrared spectroscopy. Agricultural Engineering Department, Louisiana State University, Louisiana.

Clarke, S.J. 1991. Associate Professor, Audubon Sugar Institute, Louisiana State University, Baton Rouge, Louisiana, 70803.

Tanimoto, T. 1964. The press method of cane analysis. The Hawaiian Planters Record 57(2):133-150.

Trebor. 1986. Trebor calibration programs for use with the IBM computer. Version 1.0 Trebor Industries, Inc. Gaithersburg, Maryland.

Trebor. 1991. Application laboratory report. Evaluation of near-infrared transmission spectroscopy for quality measurement of sugar cane. Trebor industries, Inc. Gaithersburg, Maryland.

1990-92 BOILER RESULTS

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Introduction:

The American Sugar Cane League funded a study to investigate bagasse boiler efficiency and boiler operating conditions at Louisiana raw sugar factories. All Louisiana factories participated in the three year study and nearly 300 boiler tests were conducted.

Data Collected:

The data collected is summarized in Table 1 for each of the three years (1990, 1991, and 1992). The data collected included the steam flow, steam pressure and steam temperature. The maximum, minimum and average furnace temperature in each of the furnace cells were recorded along with the pile heights in each cell. The temperature of the preheated combustion air leaving the air preheater, the static pressure fo the forced draft fan and the plenum air pressure, and the RPM of the forced draft fan were measured. The temperature of the flue gases leaving the boiler, the temperature of the flue gases leaving the air preheater, the draft at the induced draft fan suction, the discharge pressure of the induced draft fan, and the RPM of the induced draft fan were recorded. The flue gas was analyzed for % oxygen. The lack of certain data for a run generally indicates that it was not possible to obtain that data.

Samples of mill run bagasse were taken during the boiler tests and the bagasse was analyzed for moisture and ash content.

Data Handling:

A computer program was written to accept the data and calulate all of the flue gas components and weights. The program was also used to calculate the quantity of excess air, the theoretical maximum boiler efficiency (assuming no radiation or blowdown losses), the expected boiler outlet gas temperature, the quantity of bagasse burned, and the steam production per pound of bagasse.

The program also calculates the volume of combustion air, the volume of flue gases, and the overall heat transfer coefficient achieved in the air preheater.

Results:

The results are tabulated in Table 2 for each of the three years, and include the calculated excess air figure, the boiler efficiency (assuming 3% radiation and other heat losses), the theoretical maximum furnace temperature, the calculated boiler outlet temperature, the quantity of bagasse required for the measured steam production, and the steam production per pound of bagasse.

The range in the measured variables for 1992, along with the average for that year, is shown below together with the corresponding figures for 1991 and 1990:

	1992			1991	1990
	Low	High	Ave.	Ave.	Ave.
Furnace Temperature, F	241	1899	1263	1345	1425
Preheated Air Temperature, F	212	557	403	391	410
Plenum Air Pressure, Ins. water	-0.1	3.4	1.4	1.9	1.7
I. D. Fan Suction, Ins. water	1.6	10.0+	6.4	6.2	5.6
I. D. Fan Discharge, Ins. water	-4.2	7.1	1.7	2.4	3.2
I. D. Fan Delta, Ins. water	3.5	13.3+	7.5	8.3	8.8
I. D. Fan Speed, RPM	517	1350	949	959	980
Stack Gas Temperature, F	239	577	421	446	431
Moisture % Bagasse	49.8	60.8	57.9	54.2	55.2
Ash % Bagasse	1.3	9.2	4.6	2.0	2.7
Air Preheater tube wall temperature at air inlet, F	--	--	207	204	198
Flue Gas, % Oxygen	1.3	20.0	10.1	9.8	10.0
Excess Air, %	-6.7	919.6	124.5	96.5	112.6
Boiler Efficiency (3% loss), %	34.4	63.3	53.5	56.4	54.7
Gas Velocity in A/H, ft/sec	19.0	159.5	58.6	59.4	52.4
Heat Transfer Coefficient in A/H, Btu/hr/sq.ft./deg. F	1.3	10.2	4.7	4.4	3.6
Lbs Steam/Lb Bagasse	2.3	1.0	1.8	2.1	2.0

Table 1

1990 BOILER DATA

Mill	Date	Run No.	Boiler No.	Furnace/ Boiler	Steam lbs/hr	Steam psig	Temperature, deg. F Furn.	Temperature, deg. F Prhtr.	Temperature, deg. F Flue	Draft, " Water F.D.	Draft, " Water I.D. Suct.	Draft, " Water I.D. Disch.	I.D. Fan RPM	Flue Gas % O2	Bagasse % Moist.	Bagasse % Ash
A	12/10	1	1	D	100,000	190	-	400*	402	-	5.0	-	700	8.1	55.25	2.66
A	12/10	1	3	D	60,000	187	-	400	471	-	5.3	-	590	11.9	55.25	2.66
A	12/10	1	4	D	90,000	190	-	500*	432	-	5.1	-	600	12.3	55.25	2.66
A	12/10	1	5	G	137,000	197	-	500	485	-	7.0	-	980	5.8	55.25	2.66
B	11/14	1	1	D	91,000	213	-	385	403	-	5.6	-	909	8.7	52.12	1.87
B	11/14	1	2	D	115,700	216	-	430	416	-	4.3	-	1000	9.1	52.12	1.87
B	11/14	1	3	D	109,200	220	-	415	413	-	-	-1.1	1185	8.2	52.12	1.87
B	11/14	1	4	D	94,900	216	-	435	421	-	8.0	-	1045	10.7	52.12	1.87
C	12/03	1	3	G,W	62,000	215	-	275*	600	-	5.3	-	1180	8.6	55.80	1.99
C	12/03	1	5	G,W	44,000	212	-	223*	488	-	3.9	-	1145	12.2	55.80	1.99
C	12/03	2	5	G,W	44,000	212	-	223*	537	-	4.5	-	1171	7.5	55.80	1.99
D	12/07	1	1	G	62,500	212	-	451	380	-	5.4	-	1027	18.0	57.51	9.56
D	12/07	1	2	H	12,500	208	-	211	309	-	3.0	-	1048	18.0	57.51	9.56
D	12/07	1	3	H	28,140	207	-	356	284	-	3.4	-	891	15.0	57.51	9.56
D	12/07	1	4	H	46,900	199	-	394	365	-	4.2	-	1030	16.5	57.51	9.56
D	12/07	1	5	H	85,800	219	-	290	334	-	5.0	-	810	18.0	57.51	9.56
E	10/30	1	5	H	40,000	153	-	330	452	-	7.0	-	-	7.5	55.76	1.47
E	10/30	1	6	H	13,000	220	-	"	"	-	"	-	-	"	55.76	1.47
E	10/31	1	5	H	46,000	152	-	335	519	1.8	6.8	-	-	5.0	55.76*	1.47*
E	10/31	1	6	H	42,000	242	-	"	"	"	"	-	-	"	55.76*	1.47*
E	10/31	1	7	G	45,100	172	-	285	360	1.7	6.3	-	-	15.0	55.76*	1.47*
E	11/02	1	1	H	79,100	176	-	418	417	1.0	-	-	-	10.9	55.54	1.48
E	11/02	1	2	H	25,000	170	-	"	"	1.7	-	-	-	"	55.54	1.48
E	11/02	1	5	H	40,000	164	-	335	487	0.7	-	-	-	7.9	55.54	1.48
E	11/02	1	6	H	38,000	240	-	"	"	"	-	-	-	"	55.54	1.48

- means no data. * = assumed to permit calculations. ** = plenum not available, F.D. fan static pressure reported.
H = horseshoe cells. G = stoker/grate. D = Dennis-Detrick. W = water-walled. SH = superheater.

Table 1 (Cont'd)

1990 BOILER DATA

Mill	Date	Run No.	Boiler No.	Furnace/ Boiler	Steam lbs/hr	Steam psig	Temperature, deg. F Furn.	Prhtr.	Flue	Draft, " Water F.D.	I.D. Suct.	I.D. Disch.	I.D. Fan RPM	Flue Gas % O2	Bagasse % Moist.	Bagasse % Ash
E	11/02	1	7	G	72,600	190	-	299	365	3.0	10.0	-	-	12.7	55.54	1.48
E	11/02	2	1	H	66,000	195	-	430	410	1.5	4.5	-	-	8.5	55.54	1.48
E	11/02	2	2	H	24,000	190	-	435	"	1.6	"	-	-	"	55.54	1.48
E	11/02	2	5	H	50,000	188	-	398	480	1.0	6.1	-	-	10.1	55.54	1.48
E	11/02	2	6	H	38,000	237	-	395	"	1.3	"	-	-	"	55.54	1.48
E	11/02	2	7	G	51,700	195	-	276	395	1.8	-	-	-	12.2	55.54	1.48
E	11/05	1	1	H	68,000	167	-	420	396	1.3	4.4	1.8	800	10.5	55.46	2.66
E	11/05	1	2	H	19,000	180	-	418	"	1.5	"	"	"	"	55.46	2.66
E	11/05	1	5	H	50,000	166	-	436	451	1.3	4.4	-	1050	9.5	55.46	2.66
E	11/05	1	6	H	38,000	235	-	440	"	1.1	"	-	"	"	55.46	2.66
E	11/05	1	7	G	73,700	182	-	247	382	3.9	6.2	2.3	-	11.6	55.46	2.66
E	11/05	2	1	H	69,000	195	-	429	380	1.8	4.6	1.9	-	9.9	55.46	2.66
E	11/05	2	2	H	21,000	180	-	422	"	2.2	"	-	-	"	55.46	2.66
E	11/05	2	5	H	50,000	178	-	440	454	1.1	5.7	-	-	10.4	55.46	2.66
E	11/05	2	6	H	33,000	230	-	441	"	1.3	"	-	-	"	55.46	2.66
E	11/05	2	7	G	49,500	200	-	246	371	2.9	7.0	1.9	-	11.6	55.46	2.66
E	11/14	1	1	H	75,000	193	1723	450	414	1.5	4.4	2.3	835	7.5	53.38	2.33
E	11/14	1	2	H	26,000	185	1735	"	"	1.9	"	"	"	"	53.38	2.33
E	11/14	1	5	H	50,000	184	1466	414	427	1.3	6.6	-	743	11.5	53.38	2.33
E	11/14	1	6	H	40,000	233	1302	411	"	"	"	-	"	"	53.38	2.33
E	11/14	1	7	G	66,000	190	1550	266	385	3.2	8.7	-	1132	11.3	53.38	2.33
E	12/12	1	1	H	65,000	165	1425	412	393	1.4	3.8	2.5	953	9.7	57.20	1.79
E	12/12	1	2	H	18,000	167	1096	404	"	"	"	"	"	"	57.20	1.79
E	12/12	1	3	H	-	120	1570	-	-	0.8	-	-	-	-	57.20	1.79
E	12/12	1	4	H	-	118	1103	-	-	2.0	-	-	-	-	57.20	1.79

- means no data. * = assumed to permit calculations. ** = plenum not available, F.D. fan static pressure reported.
H = horseshoe cells. G = stoker/grate. D = Dennis-Detrick. W = water-walled. SH = superheater.

Table 1 (Cont'd)

1990 BOILER DATA

Mill	Date	Run No.	Boiler No.	Furnace/ Boiler	Steam lbs/hr	Steam psig	Temperature, deg. F Furn.	Prhtr.	Flue	Draft, " Water F.D.	I.D. Suct.	I.D. Disch.	I.D. Fan RPM	Flue Gas % O2	Bagasse % Moist.	Bagasse % Ash
E	12/12	1	5	H	50,000	132	-	428	416	0.7	6.2	-	1255	8.4	57.20	1.79
E	12/12	1	6	H	38,000	225	-	"	"	"	"	-	"	"	57.20	1.79
E	12/12	1	7	G	78,100	180	704	278	368	7.2	5.0	-	1136	12.9	57.20	1.79
F	11/12	1	1	H	24,000	197	1177	492	405	1.7	7.6	-	891	11.9	54.15	2.07
F	11/12	1	2	H	21,000	197	1320	478	"	2.0	"	-	"	"	54.15	2.07
F	11/12	1	3	H	36,000	200	1416	413	"	2.1	2.6	-	"	"	54.15	2.07
F	11/12	1	4	H	24,000	200	1409	476	477	2.0	9.0	-	1135	9.6	54.15	2.07
F	11/12	1	5	H	77,000	200	1394	390	515	-	5.0	-	1245	11.2	54.15	2.07
F	11/20	1	1	H	29,000	191	1339	470	475	1.7	8.3	-	918	10.3	58.82	1.11
F	11/20	1	2	H	43,000	195	1348	472	"	1.8	"	-	"	"	58.82	1.11
F	11/20	1	3	H	49,000	197	1686	422	"	1.8	"	-	"	"	58.82	1.11
F	11/20	1	4	H	48,000	205	1544	497	499	2.0	10.5	-	1183	10.2	58.82	1.11
F	11/20	1	5	H	87,000	205	1490	395	485	-	6.5	-	1277	11.6	58.82	1.11
F	12/06	1	1	H	37,500	176	1360	475	385	1.8	10.0	-	930	13.1	56.98	5.45
F	12/06	1	2	H	50,000	182	1280	472	"	1.9	"	-	"	"	56.98	5.45
F	12/06	1	3	H	47,000	180	1346	450	"	2.0	"	-	"	"	56.98	5.45
F	12/06	1	4	H	50,000	186	1575	491	493	2.1	8.0	-	1168	7.7	56.98	5.45
F	12/06	1	5	H	85,000	188	1565	350	492	-	5.3	-	1266	9.0	56.98	5.45
I	11/09	1	1	H	10,000	148	-	395	400*	-	-	-	661	13.3	53.81	5.83
I	11/09	1	2	H	20,000	155	-	"	"	-	-	-	"	"	53.81	5.83
I	11/09	1	3	H	18,000	150	-	"	"	-	-	-	"	"	53.81	5.83
I	11/09	1	4	H	35,000	190	-	448	457	1.7	1.7	-	752	3.9	53.81	5.83
I	11/09	1	5	H	31,000	235	-	460	"	-	1.9	0.7	"	"	53.81	5.83
I	11/09	1	6	D	87,500	245	-	490	422	-	3.0	6.2	997	7.9	53.81	5.83
I	11/12	1	1	H	16,000	150	1318	384	400*	-	5.6	-	660	11.4	52.61	2.70

- means no data. * = assumed to permit calculations. ** = plenum not available, F.D. fan static pressure reported.
H = horseshoe cells. G = stoker/grate. D = Dennis-Detrick. W = water-walled. SH = superheater.

Table 1 (Cont'd)

1990 BOILER DATA

Mill	Date	Run No.	Boiler No.	Furnace/ Boiler	Steam lbs/hr	Steam psig	Temperature, deg. F Furn.	Prhtr.	Flue	Draft, " Water F.D.	Draft, " Water I.D. Suct.	Draft, " Water I.D. Disch.	I.D. Fan RPM	Flue Gas % O2	Bagasse % Moist.	Bagasse % Ash
I	11/12	1	2	H	25,500	158	1216	"	"	-	"	-	"	"	52.61	2.70
I	11/12	1	3	H	17,000	161	1367	"	"	2.3	"	-	"	"	52.61	2.70
I	11/12	1	4	H	42,000	235	1939	469	469	1.5	1.6	-	797	3.0	52.61	2.70
I	11/12	1	5	H	35,000	250	1822	472	"	-	"	0.8	"	"	52.61	2.70
I	11/12	1	6	D	102,500	245	1461	520	445	-	3.3	7.9	1005	5.6	52.61	2.70
I	12/06	1	4	H	40,000	235	1565	468	480	-	-	1.4	944	8.3	52.38	1.36
I	12/06	1	5	H	40,000	250	1436	481	"	-	2.5	1.5	"	"	52.38	1.36
I	12/06	1	6	D	100,000	-	-	515	437	-	3.1	-	1018	5.6	52.38	1.36
I	12/14	1	5	H	-	-	-	-	486	-	-	-	-	6.7	-	-
I	12/14	1	6	D	128,750	-	1376	525	441	-	3.1	5.2	1013	7.0	-	-
J	11/20	1	1	G,W	88,000	245	-	425*	420	-	5.8	-	853	7.8	50.15	1.65
J	11/20	1	2	G,W	115,000	250	-	425*	406	-	6.1	-	843	11.5	50.15	1.65
J	11/20	1	3	H,SH	110,000	230	-	425*	418	-	4.9	-	1032	10.5	50.15	1.65
J	11/20	1	4	H,SH	90,000	235	-	425*	405	-	4.2	-	997	4.0	50.15	1.65
S	11/15	1	8	G,SH	105,000	218	1078	428	385	0.8	7.8	7.1	973	12.3	57.16	1.55
S	11/19	1	5	H,SH	96,000	222	-	400*	487	-	4.1	-2.1	861	8.6	58.12	1.81
S	11/19	1	6	G,W	-	-	-	-	407	-	6.9	6.5	-	6.3	58.12	1.81
S	11/19	1	8	G,SH	-	-	-	438	394	0.6	7.4	7.1	997	11.7	58.12	1.81
S	11/19	2	8	G,SH	135,000	232	-	-	402	-	6.3	6.4	929	7.4	58.12	1.81
S	11/27	1	8	G,SH	131,385	233	-	411	393	-	7.2	6.5	989	8.4	57.67	1.94
W	11/26	1	1	H	25,000	172	1541	450	426	-	6.2	5.0	974	12.2	54.50	1.76
W	11/26	1	2	H	30,000	170	1329	430	"	-	"	"	"	"	54.50	1.76
W	11/26	1	3	G	20,000	165	-	428	470	-	5.1	6.2	960	12.2	54.50	1.76
W	11/26	1	4	G	25,000	170	-	415	"	-	"	"	"	"	54.50	1.76
W	11/26	1	6	G	80,000	180	1254	-	389	-	10.0	4.2	1059	6.0	54.50	1.76
W	11/26	1	7	G	75,000	190	1281	430	435	0.3	5.3	4.4	920	9.7	54.50	1.76

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H = horseshoe cells. G = stoker/grate. D = Dennis-Detrick. W = water-walled. SH = superheater.

Table 1

1991 BOILER DATA

Mill	Date	Run No.	Boiler No.	Furnace/ Boiler	Steam lbs/hr	Steam psig	Temperature, deg. F Furn.	Prhtr.	Flue	Draft, " Water F.D.	I.D. Suct.	I.D. Disch.	I.D. Fan RPM	Flue Gas % O2	Bagasse % Moist.	Bagasse % Ash
A	10/28	1	1	D	105,000	182	-	492	442	-	>10.0	-	825	7.0	56.40	4.22
A	10/28	1	3	D	92,000	190	-	564	500	-	8.5	-	752	9.4	56.40	4.22
A	10/28	1	4	D	65,000	186	-	425	472	-	7.0	-	684	7.1	56.40	4.22
A	10/28	1	5	G	112,500	195	-	494*	490	-	7.5	-	917	6.8	56.40	4.22
B	12/11	1	1	D	110,500	201	-	380	425	-	4.7	-	1027	9.8	53.72	1.68
B	12/11	1	2	D	97,500	201	-	425	420	-	3.7	6.2	1002	8.3	53.72	1.68
B	12/11	1	3	D	126,100	215	-	465	476	-	-	-4.0	1151	7.7	53.72	1.68
B	12/11	1	4	D	78,000	196	-	375	393	-	7.9	4.3	1011	12.6	53.72	1.68
C	12/09	1	1	G,W	38,200	215	1116	86	555	-	6.7	-	1230	8.1	49.79	1.68
C	12/09	1	2	G,W	69,600	222	1567	398	591	-	4.7	-	935	4.4	49.79	1.68
C	12/09	1	3	G,W	56,000	212	1083	247	644	1.9	6.5	-	1155	8.0	49.79	1.68
C	12/09	1	4	G,W	-	217	1164	-	-	-	-	-	-	-	49.79	1.68
C	12/09	1	5	G,W	56,200	215	1255	214	560	2.0	4.6	-	1125	10.0	49.79	1.68
D	10/21	1	1	G	93,750	228	962	409*	518	-	7.9	-	846	9.1	51.48	1.14
D	10/21	1	2	H	75,000	224	1613	468	408	-	3.5	-	657	9.6	51.48	1.14
D	10/21	1	3	H	26,800	222	862	384	340	-	3.0	-	884	14.4	51.48	1.14
D	10/21	1	4	H	53,600	229	1595	411	416	-	3.3	-	860	8.3	51.48	1.14
D	10/21	1	5	H	81,400	229	1254	373	362	-	4.4	-	695	10.9	51.48	1.14
E	10/25	1	1	H	80,000	193	1508	455	437	0.9	5.6	-	868	13.1	53.82	5.50
E	10/25	1	2	H	25,000	191	1383	448	"	2.0	"	-	"	"	53.82	5.50
E	10/25	1	3	H	-	133	1460	-	-	1.0	-	-	877	-	53.82	5.50
E	10/25	1	4	H	-	140	1379	-	-	1.8	-	-	"	-	53.82	5.50
E	10/25	1	5	H	27,000	183	1589	430	433	1.7	5.1	-	1032	10.6	53.82	5.50
E	10/25	1	6	H	50,000	245	1620	431	"	1.6	"	-	"	"	53.82	5.50
E	10/25	1	7	G	57,000	186	1669	278	370	0.9	7.0	-	1076	11.7	53.82	5.50

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H = horseshoe cells. G = stoker/grate. D = Dennis-Detrick. W = water-walled. SH= superheater.

Table 1 (Cont'd)

1991 BOILER DATA

Mill	Date	Run No.	Boiler No.	Furnace/ Boiler	Steam lbs/hr	Steam psig	Temperature, deg. F Furn.	Prhtr.	Flue	Draft, " Water I.D. F.D.	I.D. Suct.	I.D. Disch.	I.D. Fan RPM	Flue Gas % O2	Bagasse % Moist.	Bagasse % Ash
F	11/01	1	1	H	42,000	185	1137	458	499	1.5	5.5	-	935	10.0	55.23	2.30
F	11/01	1	2	H	43,500	188	1361	465	452	1.6	-	-	-	11.3	55.23	2.30
F	11/01	1	3	H	45,000	184	1115	446	404	1.7	5.5	-	-	12.5	55.23	2.30
F	11/01	1	4	H	35,000	185	1139	453	392	1.9	7.6	-	1180	9.5	55.23	2.30
F	11/01	1	5	H	101,000	185	941	418	448	5.1**	5.0	-	1265	9.2	55.23	2.30
G	10/23	1	1	G,W	33,000	210	993	90	510	-	9.6	-0.6	1373	8.5	54.36	2.02
G	10/23	1	2	G,W	33,000	210	-	90	551	-	5.7	-0.6	1108	4.5	54.36	2.02
G	10/23	1	3	G,W,SH	40,000	220	-	90	546	-	8.7	-	871	5.8	54.36	2.02
G	10/23	1	4	G,W,SH	42,000	210	-	90	544	-	7.5	-	1219	7.5	54.36	2.02
G	10/23	1	5	G,W,SH	80,000	215	-	364*	374	-	8.8	-	932	13.5	54.36	2.02
G	10/23	1	6	G,W,SH	80,000	225	770	364	447	-	9.4	-	960	5.9	54.36	2.02
H	11/25	1	80	G,SH	85,000	247	1190	486	492	5.5	>10.0	-2.3	1245	10.8	49.79	2.80
H	11/25	1	86	G,SH	85,000	249	1294	499	456	7.0	>10.0	-2.3	1155	9.3	49.79	2.80
H	11/15	1	88	G,SH	145,000	228	1047	475	447	0.2	8.5	5.3	815	10.5	49.79	2.80
I	10/18	1	1	H	31,500	146	989	350	400*	-	5.3	-	-	12.3	56.45	1.42
I	10/18	1	3	H	13,500	153	1547	"	"	-	"	-	-	"	56.45	1.42
I	10/18	1	4	H	45,000	230	1702	470	493	1.6	2.5	1.7	947	8.1	56.45	1.42
I	10/18	1	5	H	33,000	250	1517	505	"	2.0	"	"	"	"	56.45	1.42
I	10/18	1	6	D	112,500	232	1411	529	429	-	3.0	-	994	5.4	56.45	1.42
I	10/18	1	7	D	90,000	250	1263	458	418	-	3.2	-	902	13.0	56.45	1.42
I	11/20	1	4	H	30,000	210	1582	443	464	1.6	2.7	2.4	940	9.5	56.81	2.87
I	11/20	1	5	H	36,000	225	1464	477	"	2.2	"	"	"	"	56.81	2.87
I	11/20	1	7	D	95,000	250	1084	406	383	-	2.2	6.6	983	11.9	56.81	2.87
J	11/08	1	1	G,W	111,000	270	1613	228	453	-	6.9	3.3	924	6.9	52.64	2.36
J	11/08	1	2	G,W	110,000	268	1384	420	464	-	6.9	3.5	930	6.4	52.64	2.36

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Table 1 (Cont'd)

1991 BOILER DATA

Mill	Date	Run No.	Boiler No.	Furnace/ Boiler	Steam lbs/hr	Steam psig	Temperature, deg. F Furn.	Prhtr.	Flue	Draft, " Water F.D.	I.D. Suct.	I.D. Disch.	I.D. Fan RPM	Flue Gas % O2	Bagasse % Moist.	Bagasse % Ash
J	11/08	1	3	H,SH	90,000	250	1489	438	393	-	4.9	4.5	1115	4.8	52.64	2.36
J	11/08	1	4	H,SH	81,000	260	1571	380	414	-	4.1	2.8	1092	8.1	52.64	2.36
K	11/07	1	1	D	37,000	142	1562	347	414	-	8.0	-	1010	11.2	54.52	2.27
K	11/07	1	2	D	40,000	146	1841	343	"	-	"	-	"	"	54.52	2.27
K	11/07	1	3	H	50,000	158	1741	431	380	-	4.7	-	910	11.2	54.52	2.27
K	11/07	1	4	H	50,000	150	1655	456	"	-	"	-	"	"	54.52	2.27
K	11/07	1	5	G	85,000	168	1071	484	371	-	10.0	-	1118	14.8	54.52	2.27
L	10/21	1	1	H	25,450*	150	1553	450	-	-	-	-	-	10.6	50.68	1.13
L	10/21	1	2	H	25,450*	160	1628	460	-	-	-	-	-	"	50.68	1.13
L	10/21	1	3	H	39,100	160	1711	470	598	-	10.5	-	-	"	50.68	1.13
L	10/21	1	4	G	80,000	200	754	460	499	0.4	4.5	-	1018	4.9	50.68	1.13
N	11/06	1	1	G	113,800	157	1243	455	511	-	7.0	-	882	5.1	54.70	1.18
N	11/06	1	2	G	124,100	167	1256	525	582	-	6.5	-	891	4.4	54.70	1.18
N	11/06	1	3	D	121,500	165*	-	425	361	-	5.2	-	1000	7.9	54.70	1.18
N	11/06	1	6	G	100,000	184	1341	475*	495	-	>10.0	-	1187	7.8	54.70	1.18
O	12/02	1	3	D	100,000	170	1265	378	430	1.1	5.6	-0.8	897	11.7	53.13	1.70
O	12/02	1	4	G	120,000	180	976	392	424	0.4	4.5	-0.8	758	10.3	53.13	1.70
O	12/02	1	7	G	90,000	170	1155	481	443	0.2	3.4	-0.6	1210	3.7	53.13	1.70
P	12/04	1	5	H	100,000	175	1720	407	446	0.9	5.6	-0.8	914	7.9	51.98	2.62
P	12/04	1	6	H	66,000	173	1712	465	449	2.3	4.7	-0.7	816	11.9	51.98	2.62
P	12/04	1	7	D	138,000	173	1346	538	511	2.0	5.4	-	864	8.7	51.98	2.62
Q	12/06	1	2	G,SH	155,000	211	1404	423	384	1.3	9.8	-0.7	635	7.2	59.82	1.17
Q	12/06	1	3	G	38,000	212	1417	369	448	0.2	3.5	0.0	1092	7.0	59.82	1.17
Q	12/06	1	4	G	84,000	208	1286	401	379	0.3	3.2	0.7	855	9.1	59.82	1.17
Q	12/06	1	5	G	80,000	223	723	475	349	0.0	6.7	-0.5	604	9.4	59.82	1.17

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Table 1 (Cont'd)

1991 BOILER DATA

Mill	Date	Run No.	Boiler No.	Furnace/ Boiler	Steam lbs/hr	Steam psig	Temperature, deg. F Furn.	Prhtr.	Flue	Draft, " Water F.D.	I.D. Suct.	I.D. Disch.	I.D. Fan RPM	Flue Gas % O2	Bagasse % Moist.	Bagasse % Ash
R	12/06	1	5	G	45,000	165	983	375	400	-	-	-1.3	1067	12.7	56.45	1.28
R	12/06	1	7	D	88,000	163	1050	420	398	-	5.2	-	801	10.5	56.45	1.28
R	12/06	1	8	D	90,000	168	1128	440	425	-	5.0	-	785	9.1	56.45	1.28
R	12/06	1	9	G	94,000	166	1115	440	477	-	9.7	-	1026	10.4	56.45	1.28
R	12/06	1	10	G	100,000	164	823	440	479	-	>10.0	-	981	9.6	56.45	1.28
S	10/14	1	8	G,SH	104,000	247*	-	387	351	-	6.4	-	-	13.0	55.42	0.91
S	10/14	2	8	G,SH	130,000	247*	-	405	377	-	7.4	-	-	10.0	55.42	0.91
S	10/14	3	8	G,SH	111,000	247*	1140	405	378	-	7.4	-	-	10.2	55.42	0.91
S	11/26	1	8	G,SH	126,400	228	866	417	368	-	7.4	6.7	971	10.7	57.76	1.40
S	11/26	2	8	G,SH	136,200	230	1286	411	380	-	7.6	7.1	998	9.0	57.76	1.40
S	11/26	3	8	G,SH	133,400	231	1154	408	379	-	7.9	7.0	1012	10.0	57.76	1.40
S	12/18	1	1	H	32,000	150	1778	290	415*	-	7.7	-	543	14.9	54.47	2.16
S	12/18	1	2	H	23,000	155	1588	"	"	-	"	-	"	"	54.47	2.16
S	12/18	1	3	H	68,800	170	1742	360	415*	-	9.3	-	941	12.9	54.47	2.16
S	12/18	1	4	H	71,000	170	1612	365	415*	-	6.4	-	819	14.9	54.47	2.16
S	12/18	1	5	H,SH	90,000	210	1491	415	526	-	8.0	-	972	4.4	54.47	2.16
S	12/18	1	6	G,W	70,000	184	1677	370	333	-	4.0	0.5	1034	12.3	54.47	2.16
S	12/18	1	7	H,SH	105,000	250	1536	455	397	-	6.6	-	1124	8.1	54.47	2.16
S	12/18	1	8	G,SH	175,000	265	950	432	410	-	7.5	8.8	1068	6.3	54.47	2.16
U	11/11	1	3	G	25,000	130	1169	75	688	-	-	-	-	13.1	54.19	1.56
U	11/11	1	4	G	55,000	135	754	355	394	0.1	2.8	-0.3	965	13.3	54.19	1.56
U	11/11	1	5	G	50,000	130	1625	75	413	0.9**	3.3	-0.1	966	14.1	54.19	1.56
U	11/11	1	6	G	39,550	130	1641	75	521	1.2**	-	-	-	12.0	54.19	1.56
W	12/13	1	1	H	27,000	172	1544	395	402	2.9	4.9	5.7	925	11.4	53.07	1.01
W	12/13	1	2	H	37,000	169	1346	343	"	-	"	"	"	11.4	53.07	1.01

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Table 1 (Cont'd)

1991 BOILER DATA

Mill	Date	Run No.	Boiler No.	Furnace/ Boiler	Steam lbs/hr	Steam psig	Temperature, deg. F Furn.	Prhtr.	Flue	Draft, " Water F.D.	I.D. Suct.	I.D. Disch.	I.D. Fan RPM	Flue Gas % O2	Bagasse % Moist.	Bagasse % Ash
W	12/13	1	3	G	20,000	168	1751	459	447	6.4	6.0	7.7	1060	12.3	53.07	1.01
W	12/13	1	4	G	26,000	168	1734	463	"	5.4	"	"	"	"	53.07	1.01
W	12/13	1	6	G	72,000	169*	1720	441	400	-	8.1	5.0	993	9.8	53.07	1.01
W	12/13	1	7	G	80,000	169*	1504	492	461	0.3	5.7	6.0	927	9.1	53.07	1.01

- means no data. * = assumed to permit calculations. ** = plenum not available, F.D. fan static pressure reported.
H = horseshoe cells. G = stoker/grate. D = Dennis-Detrick. W = water-walled. SH= superheater.

Table 1

1992 BOILER DATA

Mill	Date	Run No.	Boiler No.	Furnace/ Boiler	Steam lbs/hr	Steam psig	Temperature, deg. F Furn.	Prhtr.	Flue	Draft, " Water F.D.	Draft, " Water I.D. Suct.	Draft, " Water I.D. Disch.	I.D. Fan RPM	Flue Gas % O2	Bagasse % Moist.	Bagasse % Ash
B	12/04	1	1	D	91,000	204	-	375	406	-	4.6	5.0	1032	8.0	49.77	6.03
B	12/04	1	2	D	97,500	206	-	445	377	-	6.8	3.1	1027	7.5	49.77	6.03
B	12/04	1	3	D	117,000	212	-	455	443	-	>10.0	-4.2	1093	10.0	49.77	6.03
B	12/04	1	4	D	110,500	208	-	425*	465	-	7.3	2.3	1072	5.5	49.77	6.03
C	12/18	1	1	G,W	20,000	207	-	67	517	-	7.0	-	1200	15.8	53.26	6.78
C	12/18	1	2	G,W,SH	55,000	222	1021	317*	526	-	5.1	-	959	4.7	53.26	6.78
C	12/18	1	3	G,W,SH	60,000	211	1257	317*	577	-	4.4	-	730	5.9	53.26	6.78
C	12/18	1	4	G,W,SH	-	218	880	-	-	-	-	-	-	-	53.26	6.78
C	12/18	1	5	G,W,SH	57,000	218	1157	275	484	-	-	-	998	9.1	53.26	6.78
C	12/18	1	6	G,W,SH	40,000	212	791	360	356	-	>10.0	-	1150	14.1	53.26	6.78
C	12/18	2	6	G,W,SH	50,000	220	-	360	412	-	-	-	-	11.5	53.26	6.78
D	11/18	1	1	G	125,000	239	452	471	471	-	9.5	-	840	6.5	55.31	3.04
D	11/18	1	2	H	100,000	230	959	410	447	3.0	3.9	-0.4	1017	8.8	55.31	3.04
D	11/18	1	3	H	6,700	167	241	212	239	1.9	4.3	3.8	840	19.0	55.31	3.04
D	11/18	1	4	H	40,200	232	971	386	416	1.3	5.9	4.0	1030	8.7	55.31	3.04
D	11/18	1	5	H	77,000	237	1432	406	399	-	4.7	1.3	792	12.1	55.31	3.04
F	11/20	1	1	H	50,000	182	-	435	380	-	-	-	-	10.0	60.78	3.80
F	11/20	1	2	H	50,000	182	-	430	"	-	-	-	-	"	60.78	3.80
F	11/20	1	3	H	50,000	182	-	432	"	-	-	-	-	"	60.78	3.80
F	11/20	1	4	H	50,000	182	-	481	455	-	-	-	-	9.0	60.78	3.80
F	11/20	1	5	H	50,000	182	-	490	522	-	-	-	-	9.0	60.78	3.80
G	12/15	1	1	G,W	37,000	200	1619	72	532	-	9.4	-0.93	1350	6.8	56.37	7.65
G	12/15	1	2	G,W	28,000	200	1592	72	520	-	7.9	-0.96	1248	4.8	56.37	7.65
G	12/15	1	3	G,W,SH	70,000	200	1067	72	615	-	3.9	0.0	782	7.2	56.37	7.65
G	12/15	1	4	G,W,SH	26,000	200	1411	72	529	-	7.0	-1.0	1170	10.0	56.37	7.65

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Table 1 (Cont'd)

1992 BOILER DATA

Mill	Date	Run No.	Boiler No.	Furnace/ Boiler	Steam lbs/hr	Steam psig	Temperature, deg. F Furn.	Prhtr.	Flue	Draft, " Water F.D.	Draft, " Water I.D. Suct.	Draft, " Water I.D. Disch.	I.D. Fan RPM	Flue Gas % O2	Bagasse % Moist.	Bagasse % Ash
G	12/15	1	5	G,W,SH	110,000	200	1329	460	364	-	6.6	1.5	811	1.2	56.37	7.65
G	12/15	1	6	G,W,SH	85,000	200	934	385	517	-	8.5	5.0	978	5.3	56.37	7.65
G	12/15	2	5	G,W,SH	110,000	200	-	460	364	-	-	-	1022	3.6	56.37	7.65
H	12/18	1	1	G,SH	100,000	195	1092	445	358	-	>10.0	3.3	931	16.0	57.48	9.18
H	12/18	1	2	G,SH	100,000	200	832	445*	416	-	7.0	3.9	762	11.9	57.48	9.18
H	12/18	1	3	G,SH	90,000	225	866	557	494	-	7.9	-1.8	1020	6.4	57.48	9.18
H	12/18	1	4	G,SH	60,000	215	-	333	274	-	>10.0	-	1160	11.3	57.48	9.18
I	10/20	1	4	H	-	-	-	-	483	-	-	1.3	1239	7.0	57.26	3.56
I	10/20	1	6	D	112,000	222	1400	522	454	-	3.7	4.2	1017	7.1	57.26	3.56
I	10/20	1	7	D	90,000	222	1340	422	395	-	2.2	5.7	963	5.3	57.26	3.56
I	10/27	1	6	D	108,750	238	1323	533	450	-	3.8	-	1020	8.5	53.05	2.06
I	10/27	1	7	D	85,000	242	895	442	434	1.3	3.1	6.4	1116	10.5	53.05	2.06
I	10/27	2	7	D	105,000	242	-	442	434	-	-	-	-	4.4	53.05	2.06
I	10/27	3	7	D	110,000	242	-	442	434	-	-	-	-	4.4	53.05	2.06
I	12/01	1	7	D	90,290	252	-	431	426	-	-	3.4	1108	10.4	54.52	5.49
I	12/01	2	7	D	94,000	252	-	432	428	-	-	-	-	10.0	54.52	5.49
J	10/19	1	1	G,W	110,000	280	1492	440	462	-	6.7	-	886	5.6	55.10	1.34
J	10/19	1	2	G,W	125,000	283	1234	400	441	-	6.8	-	857	6.2	55.10	1.34
J	10/19	1	3	H,SH	90,000	240	1518	466	430	-	5.1	-	1189	6.3	55.10	1.34
J	10/19	1	4	H,SH	75,000	270	1513	380	415	-	3.7	-	1057	8.6	55.10	1.34
K	10/22	1	2	D	21,000	128	1480	323	356	0.4	8.1	-	942	16.0	52.52	2.09
K	10/22	1	3	H	27,000	155	1790	402	368	2.5	3.8	-	764	12.0	52.52	2.09
K	10/22	1	4	H	26,100	148	1771	434	"	1.9	"	"	"	"	52.52	2.09
K	10/22	1	5	G	82,500	153	1899	505	347	0.6	>10.0	-	943	14.1	52.52	2.09
K	10/22	1	7	G	85,000	148	1311	419	420	1.4	-	5.7	858	9.2	52.52	2.09

- means no data. * = assumed to permit calculations. ** = plenum not available, F.D. fan static pressure reported.
H = horseshoe cells. G = stoker/grate. D = Dennis-Detrick. W = water-walled. SH= superheater.

Table 1 (Cont'd)

1992 BOILER DATA

Mill	Date	Run No.	Boiler No.	Furnace/ Boiler	Steam lbs/hr	Steam psig	Temperature, deg. F Furn.	Prhtr.	Flue	Draft, " Water I.D. F.D.	I.D. Suct.	I.D. Disch.	I.D. Fan RPM	Flue Gas % O2	Bagasse % Moist.	Bagasse % Ash
K	10/29	1	2	D	21,000	155	1186	342	374	0.7	7.7	-	953	13.5	53.47	1.81
K	10/29	1	3	H	42,750	154	1513	407	390	1.9	4.2	-	849	11.0	53.47	1.81
K	10/29	1	4	H	45,000	145	1679	436	"	1.4	"	"	"	"	53.47	1.81
K	10/29	1	5	G	96,000	161	1674	524	356	0.3	>10.0	-	931	14.7	53.47	1.81
K	10/29	1	7	G	100,000	150	1292	471	420	1.1	2.3	7.1	880	7.0	53.47	1.81
K	12/10	1	2	D	22,750	147	1440	318	338	-	-	-	-	15.8	54.07	1.95*
K	12/10	1	3	H	31,500	158	1623	389	369	-	-	-	-	10.7	54.07	1.95*
K	12/10	1	4	H	33,750	150	1684	418	"	"	"	"	"	"	54.07	1.95*
K	12/10	1	5	G	84,000	160	1580	490	318	-	-	-	-	15.2	54.07	1.95*
K	12/10	1	7	G	100,000	152	1167	507	398	-	-	-	-	10.5	54.07	1.95*
L	10/23	1	1+2+3	H	80,000	147	-	479	448	1.8	6.4	-	929	9.4	59.17	1.69
L	10/23	1	4	G	56,000	224	-	401	475	0.8**	3.7	-	1018	2.8	59.17	1.69
L	10/23	1	5	D	28,000	229	-	373	348	-	1.6	6.3	1264	15.6	59.17	1.69
N	12/21	1	1	G	83,800	175	1435	492	487	0.7	7.3	-	895	9.3	55.00	3.80
N	12/21	1	2	G	56,100	172	1169	487	488	1.1	6.6	-	852	12.2	55.00	3.80
N	12/21	1	3	D	94,400	177	1744	453	331	2.7	7.2	-	718	14.9	55.00	3.80
N	12/21	1	6	G	110,900	170	982	522	497	-.1	8.1	-	1004	9.5	55.00	3.80
O	12/08	1	3	D	30,000	168	981	306	309	0.6	8.5	-0.6	929	16.9	53.09	6.46
O	12/08	1	4	G	120,000	190	798	425	429	0.2	4.4	-0.6	732	7.9	53.09	6.46
O	12/08	1	6	G	48,000	175	802	531	448	0.5	>10.0	-5.1	811	8.5	53.09	6.46
O	12/08	1	7	G	70,000	168	1295	456	421	0.1	6.1	-0.7	758	7.1	53.09	6.46
P	11/10	1	1	H	15,000	155	1089	-	-	-	-	-	-	-	56.88	2.59
P	11/10	1	5	H	90,000	164	1470	453	465	0.7	7.7	-0.8	1102	10.8	56.88	2.59
P	11/10	1	6	H	75,000	165	1001	480	461	3.1	4.6	-0.8	924	8.8	56.88	2.59
P	11/10	1	7	D	36,000	164	950	440	382	2.3**	4.8	-	753	14.1	56.88	2.59

- means no data. * = assumed to permit calculations. ** = plenum not available, F.D. fan static pressure reported.
H = horseshoe cells. G = stoker/grate. D = Dennis-Detrick. W = water-walled. SH= superheater.

Table 1 (Cont'd)

1992 BOILER DATA

Mill	Date	Run No.	Boiler No.	Furnace/ Boiler	Steam lbs/hr	Steam psig	Temperature, deg. F Furn.	Temperature, deg. F Prhtr.	Temperature, deg. F Flue	Draft, " Water F.D.	Draft, " Water I.D. Suct.	Draft, " Water I.D. Disch.	I.D. Fan RPM	Flue Gas % O2	Bagasse % Moist.	Bagasse % Ash
Q	12/09	1	2	G,SH	155,000	207	-	372	348	1.1	7.7	-	555	9.1	53.09	6.31
Q	12/09	1	3	G	37,000	211	1670	364	389	0.1	3.7	0.1	517	10.5	53.09	6.31
Q	12/09	1	4	G	85,000	215	1594	416	388	0.8	5.7	-	575	10.0	53.09	6.31
Q	12/09	1	5	G	90,000	220	1125	465	356	0.1	6.0	-0.4	557	7.6	53.09	6.31
S	11/23	1	1	H	33,600	146	-	284	382*	-	>10.0	-	1155	15.7	56.94	3.93
S	11/23	1	2	H	13,600	150	-	"	"	-	"	-	"	"	56.94	3.93
S	11/23	1	3	H	90,000	167	-	345	382*	-	9.8	-	939	13.0	56.94	3.93
S	11/23	1	4	H	72,000	168	-	317	382*	-	7.0	-	815	14.9	56.94	3.93
S	11/23	1	5	H,SH	60,000	212	-	448	446	-	6.8	-	994	12.8	56.94	3.93
S	11/23	1	6	G,W	90,000	182	-	366	321	-	3.2	-	884	8.4	56.94	3.93
S	11/23	1	7	H,SH	70,000	230	-	385	380	-	2.3	-	1108	5.4	56.94	3.93
S	11/23	1	8	G,SH	145,000	250	-	525	380	-	7.2	-	1030	8.5	56.94	3.93
W	11/16	1	1	H	15,000	165	1404	320	366	3.1	9.5	-	1008	13.8	52.22	4.32
W	11/16	1	2	H	33,000	172	1276	310	"	2.6	"	-	"	"	52.22	4.32
W	11/16	1	3	G	100	162	956	377	367	3.4	9.0	-	1092	16.5	52.22	4.32
W	11/16	1	4	G	20,000	172	1226	373	"	3.2	"	-	"	"	52.22	4.32
W	11/16	1	6	G	70,000	178	1305	350	375	-	7.6	-	860	7.5	52.22	4.32
W	11/16	1	7	G	88,000	190	1624	471	432	-	-	-	958	9.1	52.22	4.32

- means no data. * = assumed to permit calculations. ** = plenum not available, F.D. fan static pressure reported.
H = horseshoe cells. G = stoker/grate. D = Dennis-Detrick. W = water-walled. SH= superheater.

Table 2

1990 BOILER RESULTS

Mill	Date	Run No.	Boiler No.	Furnace/ Boiler	Excess Air %	Boiler Effic. %	Temperature,deg.F Theor. Furnace	Temperature,deg.F Boiler Outlet	Bagasse Fired Lb/hr	Lbs Steam/ Lb Bagasse	Air Preheater H.S., sq.ft.	Air Preheater Ht.Tr. Coeff.	Air Preheater Velocity, ft/sec Inlet	Air Preheater Velocity, ft/sec Outlet	Air Preheater Velocity, ft/sec Average
A	12/10	1	1	D	62.27	60.04	1990	625	46,406	2.15	14,085	3.96	59.89	47.59	53.74
A	12/10	1	3	D	129.73	52.28	1654	712	31,966	1.87	12,440	3.39	66.55	52.84	59.69
A	12/10	1	4	D	140.75	53.85	1684	752	46,561	1.93	14,085	7.01	92.04	67.72	79.88
A	12/10	1	5	G	37.32	58.07	2208	758	65,750	2.08	13,717	5.33	79.77	61.84	70.81
B	11/14	1	1	D	70.34	62.19	2019	623	36,812	2.47	15,800	2.98	46.59	37.09	41.84
B	11/14	1	2	D	75.87	61.16	2010	670	47,600	2.43	15,800	4.45	64.49	49.98	57.23
B	11/14	1	3	D	63.13	61.77	2076	652	44,495	2.45	13,941	4.23	63.34	49.73	56.53
B	11/14	1	4	D	101.96	58.58	1856	687	40,763	2.32	13,941	4.89	71.04	54.53	62.79
C	12/03	1	3	G,W	66.29	49.43	1850	734	36,826	1.68	3,793	4.06	51.91	46.09	49.00
C	12/03	1	5	G,W	132.12	47.83	1473	597	27,007	1.62	5,022	2.88	51.54	46.20	48.87
C	12/03	2	5	G,W	54.21	54.32	1922	634	23,779	1.85	5,022	1.52	33.91	30.89	32.40
D	12/07	1	1	G	611.57	25.86	902	707	87,017	0.71	9,749	41.72	397.70	286.14	314.92
D	12/07	1	2	H	611.57	35.81	698	427	12,568	0.99	10,790	2.40	51.11	44.28	47.69
D	12/07	1	3	H	250.78	52.36	1188	508	19,348	1.45	8,189	6.33	48.33	37.13	42.73
D	12/07	1	4	H	369.76	40.20	1046	629	41,989	1.11	8,189	14.31	152.11	115.18	133.64
D	12/07	1	5	H	611.57	32.32	765	522	95,643	0.89	12,080	23.92	384.49	310.88	347.68
E	10/30	1	5	H	51.38	55.78	1961	622	19,608	2.03	19,478	0.97	30.23	25.47	27.85
E	10/30	1	6	H	"	"	"	"	6,400	"	"	"	"	"	"
E	10/31	1	5	H	15.37	43.80	1947	676	28,714	1.60	19,478	1.37	55.81	48.09	51.95
E	10/31	1	6	H	"	"	"	"	26,359	1.59	"	"	"	"	"
E	10/31	1	7	G	248.28	51.86	1229	531	23,813	1.89	14,805	2.78	50.84	42.06	46.45
E	11/02	1	1	H	105.54	56.64	1771	667	38,018	2.07	21,991	3.48	68.18	53.03	60.01
E	11/02	1	2	H	"	"	"	"	12,026	"	"	"	"	"	"
E	11/02	1	5	H	57.92	55.68	1956	662	19,564	2.04	19,478	1.38	47.64	40.19	43.91
E	11/02	1	6	H	"	"	"	"	18,666	2.03	"	"	"	"	"

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Table 2 (Cont'd)

1990 BOILER RESULTS

Mill	Date	Run No.	Boiler No.	Furnace/ Boiler	Excess Air %	Boiler Effic. %	Temperature,deg.F Theor. Furnace	Temperature,deg.F Boiler Outlet	Bagasse Fired Lb/hr	Lbs Steam/ Lb Bagasse	Air Preheater H.S., sq.ft.	Air Preheater Ht.Tr. Coeff.	Air Preheater Velocity, ft/sec Inlet	Air Preheater Velocity, ft/sec Outlet	Air Preheater Velocity, ft/sec Average
E	11/02	1	7	G	150.70	57.20	1517	536	34,632	2.09	14,805	3.16	56.30	46.59	51.45
E	11/02	2	1	H	61.13	55.12	1924	653	32,681	2.01	21,991	2.70	49.76	38.80	44.28
E	11/02	2	2	H	"	"	1928	657	11,880	2.02	"	"	"	"	"
E	11/02	2	5	H	91.34	54.60	1826	709	24,983	2.00	19,478	2.48	66.31	53.31	59.81
E	11/02	2	6	H	"	"	1824	707	19,035	1.99	"	"	"	"	"
E	11/02	2	7	G	138.41	57.62	1553	527	24,487	2.11	14,805	1.81	37.83	31.99	34.91
E	11/05	1	1	H	90.16	57.84	1828	643	32,869	2.06	21,991	2.88	51.53	40.01	45.77
E	11/05	1	2	H	"	"	1827	641	9,192	"	"	"	"	"	"
E	11/05	1	5	H	79.45	54.88	1871	703	25,470	1.96	19,478	2.93	62.73	49.05	55.89
E	11/05	1	6	H	"	"	1873	706	19,434	1.95	"	"	"	"	"
E	11/05	1	7	G	122.65	57.37	1581	510	35,953	2.04	14,805	2.00	50.41	43.76	47.09
E	11/05	2	1	H	87.73	58.81	1848	633	32,862	2.09	21,991	3.15	51.39	39.57	45.48
E	11/05	2	2	H	"	"	1843	628	9,992	2.10	"	"	"	"	"
E	11/05	2	5	H	93.94	53.86	1803	714	25,960	1.92	19,478	3.01	64.63	50.27	57.45
E	11/05	2	6	H	"	"	"	715	17,190	1.91	"	"	"	"	"
E	11/05	2	7	G	121.89	58.23	1588	498	23,815	2.07	14,805	1.36	32.90	28.53	30.71
E	11/14	1	1	H	47.69	55.72	2039	667	36,181	2.07	21,991	2.95	52.48	40.66	46.57
E	11/14	1	2	H	"	"	"	"	12,537	"	"	"	"	"	"
E	11/14	1	5	H	116.01	55.44	1729	674	24,230	2.06	19,478	3.53	73.02	56.86	64.94
E	11/14	1	6	H	"	"	1727	672	19,434	2.05	"	"	"	"	"
E	11/14	1	7	G	116.12	59.47	1669	528	29,830	2.21	14,805	1.89	43.45	37.16	40.30
E	12/12	1	1	H	84.01	57.14	1821	630	32,475	2.00	21,991	2.64	48.17	37.78	42.98
E	12/12	1	2	H	"	"	1816	625	8,994	"	"	"	"	"	"
E	12/12	1	3	H	-	-	-	-	-	-	0	-	-	-	-
E	12/12	1	4	H	-	-	-	-	-	-	0	-	-	-	-

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H = horseshoe cells. G = stoker/grate. D = Dennis-Detrick. W = water-walled. SH = superheater.

Table 2 (Cont'd)

1990 BOILER RESULTS

Mill	Date	Run No.	Boiler No.	Furnace/ Boiler	Excess Air %	Boiler Effic. %	Temperature,deg.F Theor. Furnace	Temperature,deg.F Boiler Outlet	Bagasse Fired Lb/hr	Lbs Steam/ Lb Bagasse	Air Preheater H.S., sq.ft.	Air Preheater Ht.Tr. Coeff.	Air Preheater Velocity, ft/sec Inlet	Air Preheater Velocity, ft/sec Outlet	Air Preheater Velocity, ft/sec Average
E	12/12	1	5	H	63.12	55.88	1914	655	25,464	1.96	19,478	2.88	55.23	43.37	49.30
E	12/12	1	6	H	"	"	"	"	19,481	1.95	"	"	"	"	"
E	12/12	1	7	G	158.88	55.36	1446	523	40,311	1.93	14,805	3.20	63.96	53.85	58.91
F	11/12	1	1	H	126.14	55.63	1733	718	11,503	2.08	21,154	3.66	42.07	31.47	36.77
F	11/12	1	2	H	"	"	1724	708	10,065	"	"	"	"	"	"
F	11/12	1	3	H	"	"	1681	659	17,257	"	"	"	"	"	"
F	11/12	1	4	H	82.31	56.28	1947	761	11,372	2.11	7,660	2.07	30.69	23.55	27.12
F	11/12	1	5	H	113.15	52.23	1743	745	39,309	1.95	15,333	2.81	59.33	47.99	53.66
F	11/20	1	1	H	95.14	52.17	1783	751	16,136	1.79	21,154	4.06	63.02	49.04	56.03
F	11/20	1	2	H	"	"	1785	753	23,931	"	"	"	"	"	"
F	11/20	1	3	H	"	"	1754	718	27,274	"	"	"	"	"	"
F	11/20	1	4	H	93.81	51.40	1811	794	27,133	1.76	7,660	4.84	74.09	56.67	65.38
F	11/20	1	5	H	122.82	50.04	1627	717	50,510	1.72	15,333	3.82	72.22	57.98	65.10
F	12/06	1	1	H	165.25	52.22	1522	688	22,166	1.69	21,154	8.22	85.39	63.18	74.28
F	12/06	1	2	H	"	"	1521	687	29,567	"	"	"	"	"	"
F	12/06	1	3	H	"	"	1505	669	27,789	"	"	"	"	"	"
F	12/06	1	4	H	55.50	52.25	1952	764	29,560	1.69	7,660	4.10	62.88	48.96	55.92
F	12/06	1	5	H	73.95	52.15	1793	677	50,352	1.68	15,333	2.35	54.00	45.21	49.60
I	11/09	1	1	H	171.56	53.23	1499	648	5,485	1.82	15,967	2.96	43.08	33.48	38.28
I	11/09	1	2	H	"	"	"	"	10,978	"	"	"	"	"	"
I	11/09	1	3	H	"	"	1496	644	9,876	1.82	"	"	"	"	"
I	11/09	1	4	H	18.64	56.50	2236	686	18,144	1.92	10,524	2.95	48.09	38.23	43.16
I	11/09	1	5	H	"	"	2242	693	16,108	"	"	"	"	"	"
I	11/09	1	6	D	58.69	58.73	2046	703	43,753	1.99	14,923	4.22	50.89	38.58	44.73
I	11/12	1	1	H	117.21	59.06	1752	632	7,087	2.25	15,967	2.53	37.91	29.85	33.88

- means no data. * = assumed to permit calculations. ** = plenum not available, F.D. static pressure reported.
H = horseshoe cells. G = stoker/grate. D = Dennis-Detrick. W = water-walled. SH = superheater.

Table 2 (Cont'd)

1990 BOILER RESULTS

Mill	Date	Run No.	Boiler No.	Furnace/ Boiler	Excess Air %	Boiler Effic. %	Temperature,deg.F Theor. Furnace	Temperature,deg.F Boiler Outlet	Bagasse Fired Lb/hr	Lbs Steam/ Lb Bagasse	Air Preheater H.S., sq.ft.	Air Preheater Ht.Tr. Coeff.	Air Preheater Velocity, ft/sec Inlet	Air Preheater Velocity, ft/sec Outlet	Air Preheater Velocity, ft/sec Average
I	11/12	1	2	H	"	"	"	"	11,303	"	"	"	"	"	"
I	11/12	1	3	H	"	"	"	"	7,537	"	"	"	"	"	"
I	11/12	1	4	H	8.58	54.58	2330	709	20,240	2.07	10,524	3.24	53.88	42.78	48.33
I	11/12	1	5	H	"	"	2331	711	16,877	"	"	"	"	"	"
I	11/12	1	6	D	35.41	61.88	2319	738	43,586	2.35	14,923	4.07	50.21	37.91	44.06
I	12/06	1	4	H	64.21	58.84	2097	754	17,011	2.35	10,524	4.27	71.46	55.11	63.28
I	12/06	1	5	H	"	"	2105	763	17,022	2.34	"	"	"	"	"
I	12/06	1	6	D	35.16	62.17	2333	731	40,269	2.48	14,923	3.95	47.38	35.68	41.53
I	12/14	1	5	H	-	-	-	-	-	-	5,262	-	-	-	-
I	12/14	1	6	D	-	-	-	-	-	-	14,923	-	-	-	-
J	11/20	1	1	G,W	54.43	60.29	2127	665	35,605	2.47	8,204	5.79	65.04	50.85	57.95
J	11/20	1	2	G,W	119.69	60.03	1812	673	46,741	2.46	8,204	10.88	114.23	87.27	100.75
J	11/20	1	3	H,SH	97.94	60.23	1909	679	45,647	2.40	14,202	5.37	102.50	79.01	90.75
J	11/20	1	4	H,SH	17.69	60.72	2383	632	37,052	2.42	14,202	2.91	53.39	42.29	47.84
S	11/15	1	8	G,SH	139.20	55.38	1614	651	54,311	1.93	22,431	5.13	70.19	53.39	61.79
S	11/19	1	5	H,SH	67.84	53.94	1888	705	54,807	1.75	13,378	3.72	80.62	65.51	73.06
S	11/19	1	6	G,W	41.68	58.87	2051	641	67,726	1.99	15,834	-	-	-	-
S	11/19	1	8	G,SH	125.47	55.07	1653	661	72,405	1.86	22,431	-	-	-	-
S	11/19	2	8	G,SH	53.84	58.53	1974	643	68,129	1.98	22,431	4.14	60.03	46.92	53.48
S	11/27	1	8	G,SH	66.59	58.60	1917	622	65,234	2.01	22,431	4.03	60.61	47.76	54.19
W	11/26	1	1	H	137.43	54.99	1679	710	12,174	2.05	10,418	4.74	73.91	56.34	65.12
W	11/26	1	2	H	"	"	1666	695	14,606	"	"	"	"	"	"
W	11/26	1	3	G	136.13	51.97	1657	735	10,299	1.94	10,844	3.23	56.69	44.29	50.49
W	11/26	1	4	G	"	"	1649	725	12,879	"	"	"	"	"	"
W	11/26	1	6	G	35.90	59.62	2153	622	35,949	2.22	13,430	3.37	44.05	34.55	39.30
W	11/26	1	7	G	85.13	58.11	1905	688	34,604	2.16	10,511	4.58	66.22	51.58	58.90

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H = horseshoe cells. G = stoker/grate. D = Dennis-Detrick. W = water-walled. SH = superheater.

Table 2

1991 BOILER RESULTS

Mill	Date	Run No.	Boiler No.	Furnace/ Boiler	Excess Air %	Boiler Effic. %	Temperature,deg.F Theor. Furnace	Temperature,deg.F Boiler Outlet	Bagasse Fired Lb/hr	Lbs Steam/ Lb Bagasse	Air Preheater H.S., sq.ft.	Air Preheater Ht.Tr. Coeff.	Air Preheater Velocity, ft/sec Inlet	Air Preheater Velocity, ft/sec Outlet	Air Preheater Velocity, ft/sec Average
A	10/28	1	1	D	48.71	57.86	2064	704	55,647	1.88	14,085	5.01	68.65	53.20	60.92
A	10/28	1	3	D	77.89	52.86	1929	823	53,397	1.72	12,440	6.47	94.22	70.47	82.35
A	10/28	1	4	D	50.12	56.83	2023	689	35,080	1.85	14,085	2.28	43.01	34.87	38.94
A	10/28	1	5	G	45.30	55.49	2073	749	62,220	1.80	13,717	4.83	74.44	58.47	66.45
B	12/11	1	1	D	68.32	47.74	1745	635	60,648	1.82	15,800	4.26	75.59	61.06	68.32
B	12/11	1	2	D	62.73	59.48	2031	659	42,951	2.27	15,800	3.53	52.83	41.50	47.17
B	12/11	1	3	D	55.18	58.06	2111	738	56,953	2.21	13,941	4.86	81.88	63.97	72.92
B	12/11	1	4	D	144.92	55.19	1590	620	37,024	2.10	13,941	4.52	69.34	54.77	62.06
C	12/09	1	1	G,W	57.14	54.89	1912	555	17,348	2.20	0	-	-	-	-
C	12/09	1	2	G,W	19.71	54.83	2361	789	32,426	2.14	6,421	3.02	48.63	40.88	44.75
C	12/09	1	3	G,W	60.07	54.57	2058	755	26,204	2.13	3,793	2.37	40.19	36.50	38.34
C	12/09	1	4	G,W	-	-	-	-	-	-	0	-	-	-	-
C	12/09	1	5	G,W	87.46	54.35	1832	653	26,406	2.12	5,022	1.96	49.36	45.21	47.29
D	10/21	1	1	G	74.46	57.35	2030	750	41,356	2.26	9,749	4.34	78.90	63.77	71.34
D	10/21	1	2	H	82.83	61.74	2022	689	30,729	2.44	10,790	5.18	67.64	51.07	59.36
D	10/21	1	3	H	217.56	58.86	1447	588	11,516	2.32	8,189	4.06	38.94	29.73	34.33
D	10/21	1	4	H	62.77	61.05	2082	648	22,213	2.41	8,189	3.56	45.48	35.94	40.71
D	10/21	1	5	H	104.02	61.50	1826	581	33,487	2.43	12,080	4.71	65.28	51.51	58.40
E	10/25	1	1	H	164.51	52.54	1572	718	43,680	1.83	21,991	4.94	95.11	72.55	83.83
E	10/25	1	2	H	"	"	1567	713	13,648	"	"	"	"	"	"
E	10/25	1	3	H	-	-	-	-	-	-	0	-	-	-	-
E	10/25	1	4	H	-	-	-	-	-	-	0	-	-	-	-
E	10/25	1	5	H	97.28	54.59	1774	678	14,180	1.90	19,478	2.87	57.86	45.37	51.62
E	10/25	1	6	H	"	"	1775	679	26,343	1.89	"	"	"	"	"
E	10/25	1	7	G	124.65	58.57	1598	511	27,907	2.04	14,805	1.85	38.30	32.72	35.51

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Table 2 (Cont'd)

1991 BOILER RESULTS

Mill	Date	Run No.	Boiler No.	Furnace/ Boiler	Excess Air %	Boiler Effic. %	Temperature,deg.F Theor. Furnace	Temperature,deg.F Boiler Outlet	Bagasse Fired Lb/hr	Lbs Steam/ Lb Bagasse	Air Preheater H.S., sq.ft.	Air Preheater Ht.Tr. Coeff.	Air Preheater Velocity, ft/sec Inlet	Air Preheater Velocity, ft/sec Outlet	Air Preheater Velocity, ft/sec Average
J	11/08	1	3	H,SH	26.63	61.14	2311	640	39,053	2.30	10,861	4.32	73.33	56.83	65.08
J	11/08	1	4	H,SH	61.38	60.13	2054	639	35,753	2.26	10,043	3.96	61.44	48.87	55.16
K	11/07	1	1	D	114.07	56.99	1722	618	17,909	2.06	13,456	3.32	63.84	51.81	57.82
K	11/07	1	2	D	"	"	1719	615	19,368	"	13,456	"	"	"	"
K	11/07	1	3	H	110.28	57.48	1769	647	24,029	2.08	13,456	6.84	84.09	63.29	73.69
K	11/07	1	4	H	"	"	1785	665	24,013	"	13,456	"	"	"	"
K	11/07	1	5	G	234.84	51.26	1417	707	45,842	1.85	10,511	14.64	144.82	103.14	123.98
L	10/21	1	1	H	99.91	52.58	1934	866	12,124	2.09	15,904	3.11	39.07	31.00	35.04
L	10/21	1	2	H	"	"	1941	874	12,134	"	"	"	"	"	"
L	10/21	1	3	H	"	"	1947	880	18,643	"	"	"	"	"	"
L	10/21	1	4	G	23.27	56.53	2335	743	35,566	2.24	16,362	2.07	39.96	31.84	35.90
N	11/06	1	1	G	30.94	59.17	2307	750	50,482	2.25	15,021	2.94	86.34	69.32	77.83
N	11/06	1	2	G	25.49	56.99	2387	858	57,204	2.16	17,974	2.77	57.83	45.72	51.77
N	11/06	1	3	D	59.89	63.11	2080	599	50,562	2.40	21,736	3.67	60.74	47.07	53.90
N	11/06	1	6	G	58.57	58.08	2120	762	45,280	2.20	12,183	4.30	78.23	61.14	69.68
O	12/02	1	3	D	125.25	57.15	1719	657	45,368	2.20	18,234	3.55	65.10	51.87	58.48
O	12/02	1	4	G	95.96	59.42	1868	654	58,213	2.06	18,234	4.32	74.31	58.94	66.62
O	12/02	1	7	G	20.37	62.81	2434	699	37,149	2.42	18,234	2.31	33.93	26.44	30.18
P	12/04	1	5	H	59.37	60.06	2111	684	43,399	2.30	13,149	3.64	66.24	52.41	59.33
P	12/04	1	6	H	130.12	55.56	1779	753	30,960	2.13	13,149	4.29	67.35	50.42	58.88
P	12/04	1	7	D	70.29	57.10	2127	843	62,979	2.19	12,183	7.44	124.36	92.67	108.51
Q	12/06	1	2	G,SH	49.01	55.45	1934	618	89,981	1.72	23,241	4.70	85.91	67.20	76.55
Q	12/06	1	3	G	49.15	54.90	1944	645	21,147	1.79	6,964	2.41	49.46	40.60	45.03
Q	12/06	1	4	G	76.02	56.54	1818	611	45,379	1.85	13,483	4.42	63.23	49.50	56.37
Q	12/06	1	5	G	80.20	57.38	1836	634	42,619	1.87	17,907	4.67	37.44	27.66	32.55

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Table 2 (Cont'd)

1991 BOILER RESULTS

Mill	Date	Run No.	Boiler No.	Furnace/ Boiler	Excess Air %	Boiler Effic. %	Temperature,deg.F Theor. Furnace	Temperature,deg.F Boiler Outlet	Bagasse Fired Lb/hr	Lbs Steam/ Lb Bagasse	Air Preheater H.S., sq.ft.	Air Preheater Ht.Tr. Coeff.	Air Preheater Velocity, ft/sec Inlet	Air Preheater Velocity, ft/sec Outlet	Air Preheater Velocity, ft/sec Average
R	12/06	1	5	G	152.45	53.98	1556	637	23,272	1.93	-	-	-	-	-
R	12/06	1	7	D	99.59	57.31	1798	655	42,859	2.05	-	-	-	-	-
R	12/06	1	8	D	76.08	57.53	1930	687	43,685	2.06	-	-	-	-	-
R	12/06	1	9	G	97.70	53.72	1820	745	48,858	1.92	-	-	-	-	-
R	12/06	1	10	G	83.82	54.60	1888	742	51,126	1.95	-	-	-	-	-
S	10/14	1	8	G,SH	160.24	57.37	1542	591	53,644	1.93	22,431	5.25	68.19	52.59	60.39
S	10/14	2	8	G,SH	90.36	60.10	1850	613	64,012	2.03	22,431	4.58	64.24	50.09	57.16
S	10/14	3	8	G,SH	93.63	60.02	1835	615	51,766	2.02	22,431	3.75	52.73	41.08	46.91
S	11/26	1	8	G,SH	103.06	58.28	1765	614	68,647	1.84	22,431	5.20	67.85	52.31	60.08
S	11/26	2	8	G,SH	75.14	59.16	1899	612	72,877	1.86	22,431	4.54	64.05	50.19	57.12
S	11/26	3	8	G,SH	89.56	58.47	1822	613	72,232	1.84	22,431	4.79	67.58	52.79	60.18
S	12/18	1	1	H	240.69	49.06	1269	593	17,851	1.79	10,367	4.34	88.24	73.32	80.78
S	12/18	1	2	H	"	"	"	"	12,836	"	"	"	"	"	"
S	12/18	1	3	H	157.28	53.65	1543	638	35,150	1.95	8,494	6.33	118.45	94.40	106.42
S	12/18	1	4	H	243.64	48.90	1318	654	39,803	1.78	8,494	9.56	174.52	137.07	155.80
S	12/18	1	5	H,SH	22.52	55.14	2245	740	47,076	1.91	13,378	2.45	59.50	48.89	54.19
S	12/18	1	6	G,W	140.94	59.92	1621	563	32,055	2.18	15,834	4.12	57.98	44.94	51.46
S	12/18	1	7	H,SH	61.13	60.02	2043	662	50,544	2.07	18,260	4.18	53.74	41.02	47.38
S	12/18	1	8	G,SH	41.97	61.56	2182	650	84,652	2.06	22,431	4.51	69.09	54.16	61.62
U	11/11	1	3	G	165.87	38.83	1482	688	14,185	1.76	0	-	-	-	-
U	11/11	1	4	G	171.75	55.88	1529	614	25,965	2.11	8,315	5.29	65.63	52.19	58.91
U	11/11	1	5	G	202.24	52.87	1374	413	21,380	2.33	0	-	-	-	-
U	11/11	1	6	G	132.75	51.29	1591	520	18,316	2.15	0	-	-	-	-
W	12/13	1	1	H	115.45	57.14	1746	643	12,843	2.15	10,418	4.30	74.73	59.45	67.09
W	12/13	1	2	H	"	"	1712	604	17,596	2.10	"	"	"	"	"

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Table 2 (Cont'd)

1991 BOILER RESULTS

Mill	Date	Run No.	Boiler No.	Furnace/ Boiler	Excess Air %	Boiler Effic. %	Temperature,deg.F Theor. Furnace	Temperature,deg.F Boiler Outlet	Bagasse Fired Lb/hr	Lbs Steam/ Lb Bagasse	Air Preheater H.S., sq.ft.	Air Preheater Ht.Tr. Coeff.	Air Preheater Velocity, ft/sec Inlet	Air Preheater Velocity, ft/sec Outlet	Air Preheater Velocity, ft/sec Average
W	12/13	1	3	G	139.43	54.72	1712	741	9,933	2.01	10,844	4.05	59.02	44.51	51.77
W	12/13	1	4	G	"	"	1715	744	12,913	"	"	"	"	"	"
W	12/13	1	6	G	83.83	58.96	1930	665	33,188	2.16	13,430	4.13	54.96	42.00	48.48
W	12/13	1	7	G	75.44	58.72	2044	757	37,025	2.16	10,511	5.42	74.24	56.16	65.20

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Mill	Date	Run No.	Boiler No.	Furnace/ Boiler	Excess Air %	Boiler Effic. %	Temperature,deg.F Theor. Furnace	Temperature,deg.F Boiler Outlet	Bagasse Fired Lb/hr	Lbs Steam/ Lb Bagasse	Air Preheater H.S., sq.ft.	Air Preheater Ht.Tr. Coeff.	Air Preheater Velocity, ft/sec Inlet	Air Preheater Velocity, ft/sec Outlet	Air Preheater Velocity, ft/sec Average
B	12/04	1	1	D	57.84	60.34	2051	614	39,963	2.27	15,800	2.75	45.31	36.52	40.92
B	12/04	1	2	D	50.08	60.24	2112	632	42,896	2.27	15,800	4.10	47.60	36.49	42.04
B	12/04	1	3	D	66.28	43.80	1747	710	70,811	1.65	13,941	6.80	104.38	80.56	92.47
B	12/04	1	4	D	29.31	57.05	2231	692	51,333	2.15	13,941	3.34	60.97	48.94	54.95
C	12/18	1	1	G,W	301.09	34.62	956	517	17,482	1.14	0	-	-	-	-
C	12/18	1	2	G,W,SH	26.38	55.02	2161	685	31,013	1.77	6,421	2.14	37.91	32.76	35.33
C	12/18	1	3	G,W,SH	36.66	52.69	2084	735	35,311	1.69	3,793	4.00	40.32	34.98	37.65
C	12/18	1	4	G,W,SH	-	-	-	-	-	-	-	-	-	-	-
C	12/18	1	5	G,W,SH	75.48	54.82	1835	628	32,250	1.76	5,022	3.54	47.31	41.03	44.17
C	12/18	1	6	G,W,SH	197.06	51.20	1373	589	24,227	1.65	9,025	5.27	64.70	50.33	57.52
C	12/18	1	7	G,W,SH	119.23	54.87	1667	629	28,268	1.76	9,025	3.83	60.76	48.65	54.71
D	11/18	1	1	G	40.46	55.33	2105	725	65,237	1.91	9,749	7.11	94.09	73.92	84.01
D	11/18	1	2	H	71.12	57.38	1939	675	50,309	1.98	10,790	5.15	94.21	75.25	84.73
D	11/18	1	3	H	919.63	34.36	554	361	5,608	1.19	8,189	3.63	38.84	33.07	35.95
D	11/18	1	4	H	70.70	58.91	1932	628	19,701	2.04	8,189	2.68	37.28	30.00	33.64
D	11/18	1	5	H	135.29	56.11	1644	645	39,624	1.94	12,080	5.57	83.25	64.69	73.97
F	11/20	1	1	H	85.95	51.09	1660	624	32,053	1.55	21,514	6.38	70.90	54.99	62.94
F	11/20	1	2	H	"	"	1658	621	"	"	"	"	"	"	"
F	11/20	1	3	H	"	"	1659	623	"	"	"	"	"	"	"
F	11/20	1	4	H	70.10	48.39	1753	720	33,843	1.47	7,660	5.25	71.51	55.42	63.46
F	11/20	1	5	H	72.99	47.40	1787	792	77,392	1.44	15,333	5.13	87.60	68.68	78.14
G	12/15	1	1	G,W	46.25	51.07	1773	532	23,507	1.57	0	-	-	-	-
G	12/15	1	2	G,W	25.87	50.41	1861	520	18,021	1.55	0	-	-	-	-
G	12/15	1	3	G,W,SH	50.83	47.10	1738	614	49,371	1.41	0	-	-	-	-
G	12/15	1	4	G,W,SH	87.37	46.81	1513	529	18,452	1.40	0	-	-	-	-

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Table 2 (Cont'd)

1992 BOILER RESULTS

Mill	Date	Run No.	Boiler No.	Furnace/ Boiler	Excess Air %	Boiler Effic. %	Temperature,deg.F Theor. Furnace	Temperature,deg.F Boiler Outlet	Bagasse Fired Lb/hr	Lbs Steam/ Lb Bagasse	Air Preheater H.S., sq.ft.	Air Preheater Ht.Tr. Coeff.	Air Preheater Velocity, ft/sec Inlet	Air Preheater Velocity, ft/sec Outlet	Air Preheater Velocity, ft/sec Average
G	12/15	1	5	G,W,SH	-6.78	46.27	2027	575	78,977	1.39	12,315	6.48	41.48	33.02	37.25
G	12/15	1	6	G,W,SH	30.85	51.47	2013	707	54,864	1.54	12,205	2.56	30.33	25.38	27.85
G	12/15	2	5	G,W,SH	19.87	59.55	2176	598	61,363	1.79	12,315	5.99	38.19	29.74	33.96
H	12/18	1	1	G,H	311.73	37.38	1114	674	97,733	1.02	17,222	28.12	313.73	226.20	269.96
H	12/18	1	2	G,SH	131.10	48.18	1545	695	75,850	1.31	17,222	10.72	153.00	116.04	134.52
H	12/18	3		G,SH	44.09	50.86	1991	801	64,750	1.38	10,248	3.99	64.20	48.56	56.38
H	12/18	1	4	G,SH	GAS ONLY										
I	10/20	1	4	H	-	-	-	-	-	-	5,262	-	-	-	-
I	10/20	1	6	D	50.50	56.87	2062	736	61,422	1.82	14,923	5.51	69.48	53.10	61.29
I	10/20	1	7	D	30.67	58.28	2100	603	48,167	1.86	14,923	3.40	43.79	35.22	39.51
I	10/27	1	6	D	66.43	58.84	2089	771	50,198	2.16	14,923	5.72	70.13	51.82	60.97
I	10/27	1	7	D	98.36	57.58	1859	704	40,103	2.11	14,923	4.26	60.93	46.78	53.86
I	10/27	2	7	D	20.31	56.91	2255	668	50,119	2.09	14,923	3.46	50.50	40.01	45.25
I	10/27	3	7	D	14.93	52.14	2176	665	57,309	1.91	14,923	3.80	56.00	44.50	50.25
I	12/10	1	7	D	97.65	55.40	1808	693	51,548	1.75	14,923	4.75	69.09	53.09	61.09
I	12/10	1	7	D	89.91	56.17	1850	688	52,196	1.80	14,923	4.62	67.41	52.14	59.78
J	10/19	1	1	G,W	34.09	58.51	2207	692	51,073	2.15	8,204	6.10	79.35	63.49	71.42
J	10/19	1	2	G,W	39.40	59.23	2151	648	57,334	2.18	8,204	6.56	88.13	71.63	79.88
J	10/19	1	3	H,SH	41.49	60.30	2189	682	41,498	2.16	10,861	4.80	86.60	67.43	77.02
J	10/19	1	4	H,SH	69.03	60.49	1981	622	34,510	2.17	10,043	3.85	59.65	48.24	53.95
K	10/22	1	2	D	320.31	50.73	1165	570	10,910	1.92	13,456	2.15	33.51	26.53	30.02
K	10/22	1	3	H	132.48	59.63	1710	622	11,965	2.25	13,456	3.70	45.83	34.65	40.24
K	10/22	1	4	H	"	"	1731	647	11,559	"	"	"	"	"	"
K	10/22	1	5	G	203.80	57.24	1547	698	38,077	2.16	10,511	13.75	115.01	80.12	97.57
K	10/22	1	7	G	75.46	59.51	1984	669	37,720	2.25	10,511	4.92	70.29	54.79	62.54

- means no data. * = assumed to permit calculations. ** = plenum not available, F.D. fan static pressure reported.
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Mill	Date	Run No.	Boiler No.	Furnace/ Boiler	Excess Air %	Boiler Effic. %	Temperature,deg.F Theor. Furnace	Temperature,deg.F Boiler Outlet	Bagasse Fired Lb/hr	Lbs Steam/ Lb Bagasse	Air Preheater H.S., sq.ft.	Air Preheater Ht.Tr. Coeff.	Air Preheater Velocity, ft/sec Inlet	Air Preheater Velocity, ft/sec Outlet	Air Preheater Velocity, ft/sec Average
K	10/29	1	2	D	178.69	56.43	1487	585	9,832	2.13	13,456	1.32	21.16	16.88	19.02
K	10/29	1	3	H	106.87	58.20	1783	636	19,403	2.20	13,456	5.21	70.78	54.35	62.56
K	10/29	1	4	H	"	"	1803	658	20,408	"	"	"	"	"	"
K	10/29	1	5	G	232.00	53.62	1462	722	47,327	2.02	10,511	18.75	156.38	107.91	132.14
K	10/29	1	7	G	47.74	60.43	2165	688	43,703	2.28	10,511	5.82	71.99	55.18	63.59
K	12/10	1	2	D	298.44	49.14	1146	543	12,522	1.81	13,456	2.39	34.86	27.70	31.28
K	12/10	1	3	H	103.38	60.42	1805	602	14,115	2.23	13,456	3.76	48.91	37.77	43.34
K	12/10	1	4	H	"	"	1823	624	15,113	"	"	"	"	"	"
K	12/10	1	5	G	258.40	54.52	1374	664	41,716	2.01	10,511	18.54	137.94	95.49	116.71
K	12/10	1	7	G	98.07	58.41	1888	715	46,328	2.15	10,511	9.38	96.90	70.73	83.81
L	10/23	1	1+2+3	H	77.88	52.18	1832	727	46,661	1.71	15,904	3.98	29.53	22.58	26.05
L	10/23	1	4	G	8.50	50.80	2121	665	33,722	1.66	16,362	1.29	28.35	23.56	25.95
L	10/23	1	5	D	282.30	45.86	1186	596	18,680	1.49	14,923	3.32	40.79	31.19	35.99
N	12/21	1	1	G	78.77	55.12	1945	776	43,187	1.94	15,021	3.79	91.19	69.87	80.53
N	12/21	1	2	G	134.56	48.11	1665	793	32,439	1.72	17,974	2.97	42.46	48.36	36.57
N	12/21	1	3	D	244.79	54.75	1370	639	48,985	1.92	21,736	8.14	109.61	78.90	94.26
N	12/21	1	6	G	81.92	54.11	1592	769	58,197	1.90	12,183	10.15	147.49	114.80	131.14
O	12/08	1	3	D	412.08	46.34	986	520	18,529	1.61	18,234	3.23	42.90	33.64	38.27
O	12/08	1	4	G	58.62	57.66	2020	675	66,356	1.80	18,234	4.05	66.04	51.73	58.88
O	12/08	1	6	G	45.88	41.53	1811	757	33,098	1.45					
O	12/08	1	7	G	50.26	58.69	2096	684	34,141	2.05	18,234	2.26	32.88	25.32	29.10
P	11/10	1	1	H	-	-	-	-	-	-	-	-	-	-	-
P	11/10	1	5	H	105.45	53.10	1768	739	48,947	1.83	13,149	5.16	88.77	68.46	78.61
P	11/10	1	6	H	71.62	55.52	1949	741	39,020	1.92	13,149	3.86	61.58	47.23	54.41
P	11/10	1	7	D	202.40	51.01	1428	673	20,382	1.76	12,183	4.11	51.91	38.54	45.23

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Q	12/09	1	2	G,SH	73.92	60.28	1896	565	77,994	1.98	23,241	4.53	80.33	63.29	71.81
Q	12/09	1	3	G	96.92	56.51	1758	606	18,934	1.95	6,964	3.38	53.55	42.60	48.07
Q	12/09	1	4	G	90.13	58.46	1851	640	42,054	2.02	13,483	4.57	64.86	49.96	57.41
Q	12/09	1	5	G	55.19	60.95	2065	629	42,718	2.10	17,907	3.97	33.78	25.30	29.54
S	11/23	1	1	H	292.53	42.75	1093	561	23,475	1.43	10,367	5.22	94.53	77.92	86.22
S	11/23	1	2	H	"	"	"	"	9,505	"	"	"	"	"	"
S	11/23	1	3	H	160.09	51.16	1450	595	52,632	1.70	8,494	9.09	156.73	125.09	140.91
S	11/23	1	4	H	232.97	44.33	1208	583	48,603	1.48	8,494	9.38	176.48	142.47	159.47
S	11/23	1	5	H,SH	153.87	47.96	1541	732	39,751	1.50	13,378	5.00	80.30	60.98	70.64
S	11/23	1	6	G,W	64.52	59.54	1875	526	45,278	1.98	15,834	3.94	53.41	42.28	47.85
S	11.23	1	7	H,SH	21.16	48.19	1915	575	46,056	1.51	18,260	2.25	34.17	27.71	30.94
S	11/23	1	8	G,SH	67.41	58.19	1975	692	79,381	1.82	22,431	6.69	70.00	51.03	60.51
W	11/16	1	1	H	187.24	55.49	1431	553	7,693	1.94	10,418	3.85	67.99	55.60	61.80
W	11/16	1	2	H	"	"	1423	545	16,933	"	"	"	"	"	"
W	11/16	1	3	G	363.90	47.20	1127	617	60	1.65	13,430	3.65	47.11	36.20	41.66
W	11/16	1	4	G	"	"	1124	614	12,064	"	"	"	"	"	"
W	11/16	1	6	G	55.23	63.26	2077	559	31,519	2.22	13,430	2.47	39.24	32.15	35.70
W	11/16	1	7	G	75.71	60.03	2021	706	41,786	2.10	10,511	5.98	76.25	58.30	67.28

- means no data. * = assumed to permit calculations. ** = plenum not available, F.D. fan static pressure reported.
H = horseshoe cells. G = stoker/grate. D = Dennis-Detrick. W = water-walled. SH= superheater.

SUGAR FACTORY PROCESSING RESEARCH

Stephen J. Clarke
Audubon Sugar Institute

Research activities have continued in the search for improved methods of factory operation. The emphases of the work have been on development of procedures which should give reduced sugar loss, improved energy utilization, improved sugar quality and reduced environmental impact. The receipt of research grants from the American Sugar Cane league and the Louisiana Educational Quality Support Fund have made possible the current direction and expansion of research. There is much data available from our work in the laboratory and the direction at present is towards scaling up to pilot plant systems which can be operated in the factory with real process materials.

Laboratory level work is continuing on the evaluation of the formation and control of evaporator scale and on the fundamental chemistry of the clarification process. A small magnetic system, proposed for scale control, was tested on our scaling evaporator but did not show any improvement over the control samples.

CLARIFICATION:

A pilot scale flotation clarifier was constructed and evaporated at a mill on unheated limed juice. A high molecular weight neutral polyacrylamide flocculant was necessary for efficient flotation, though similar results were obtained with a high molecular weight polyethylene oxide. The purpose of this treatment was to remove as much of the suspended solids, especially field soil and small cane and leaf particles, before the juice was heated and so avoid solubilization of components of these materials. The quality of the juice produced in the system was as good as the factory juice in terms of turbidity. As expected, some precipitation occurred when this juice was heated and this approach would require a two stage clarification process rather than the conventional single stage used for raw sugar production.

FILTRATION:

Two pilot scale filtration systems were tested and these quite different approaches are, first, for material with high solids content and relatively low flow rates (for example, clarifier underflow) and, second, for liquors with low solids content and high flow rates (for example, clarified juice and syrup).

In the first case any filter that could replace the conventional rotary vacuum filter must have a high solids retention (to avoid recycle thereby increasing clarifier capacity and reducing juice deterioration) and a low cake moisture (to minimize waste disposal problems). These conditions were achieved with a pilot scale Putsch membrane press

filter running on mud directly from the clarifier. For best results the pH of the clarifier underflow had to be raised to at least 8 and a polymeric flocculant added. Bagacillo was added to the filter feed for some of the tests. The results achieved are tabulated, along with the typical Louisiana data on rotary vacuum filters -

	MEMBRANE PRESS		
	WITH BAGACILLO	WITHOUT BAGACILLO	ROTARY VACUUM FILTER
% MOISTURE IN CAKE	51 - 60	48 - 54	70 - 85
% POL IN CAKE	1.2 - 2.7	1.8 - 3.9	1.0 - 3.9
% SOLIDS RETENTION	98+	98+	55 - 95

The much lower moisture content results in a much reduced quantity of cake to be disposed of and the material is much easier to handle.

For the removal of bagacillo and other fine solids from juice and syrup (also removal of scale particles from the latter) a Filtomat self-cleaning filter was used. the advantages of this should be improved sugar quality and recirculation in the pans and these have been demonstrated by researchers in the beet industry. The filter screens used varied in size from 15 microns to 100 microns. Several difficulties were encountered in this work, especially due to insufficient pressure on the backwash system. Good preliminary results were obtained on factory syrup and the system is currently under trial in a cane sugar refinery for removal of solids from recirculated sweet water from the refinery sump and for remelted sugar containing starch granules.

ION-EXCHANGE: [1]

A process for the softening of clarified juice by ion-exchange has been tested on raw sugar factory clarified juice. The ion-exchange resin used is a carboxylic resin in the acid form. Juice passing through the column initially exchanges cations in the juice (mainly potassium and calcium) for the hydrogen ions with a reduction in juice pH. This juice is neutralized immediately with sodium hydroxide. As the softening process proceeds the calcium in the juice replaces the potassium until the softening capacity is exhausted. The resin is regenerated with phosphoric acid. The effluent calcium phosphate/excess phosphoric acid is returned to the mixed juice treatment where it results in a reduction of calcium in the clarified juice prior to the ion-exchange system. The

[1]Youjian Xu, Graduate Student

spent phosphoric acid would leave the factory in the filter cake which is best used as a soil adjuvant.

High flow rates for the hot juice are necessary to avoid sucrose loss but have the adverse effect of reducing the efficiency of the softening process. Conditions have been developed which reduce the calcium level sufficiently for scale reduction or prevention. With increased resin usage it is possible to sufficiently soften the juice to make further softening unnecessary before use of an ion-exchange system.

TREATMENT OF CANE WASH WATER:

A small commercial lamella clarifier was used to remove field soil suspended in the cane wash water leaving the tables at two mills. Provided that the pH was maintained above 8 with lime and a flocculant was used, very good water quality in the overflow was achieved. The retention time in the system was only a few minutes and the oxygenated condition of the water due to the wash table is maintained. A heavy settled soil stream was achieved which could easily be handled with a simple belt filter. No acidity formation was observed in the clarifier and the water could be reused immediately for washing cane. Implementation of a full scale system using this technology would greatly reduce water and land usage. Initial capital costs would be high but it would provide a long term solution.

DESUGARIZATION OF CANE MOLASSES

M. Saska, Ch. Pelletan and Mei Di Wu
Audubon Sugar Institute

In 1992/93 season, in the five existing ion exclusion plants in the US, nearly half of the US beet molasses production was expected to be desugarized adding another 250,000 tons or 6 % to the beet sugar production of 4.2 million tons. Even before the installation in 1988 of the first beet molasses desugarization plant at the Amalgamated Sugar Company's Twin Falls factory, the interest existed in applying the same technology to the sugarcane molasses. Yet, as of now, with the exception of two medium sized plants installed in Okinawa by Mitsubishi Kasei in the middle 80's, the adoption in the cane industry has not materialized, despite dedicated programs at several R & D groups. Undoubtedly, the lower sucrose content of the cane molasses (40 % on Brix versus 55 % for beet) makes the economics right off less attractive, even though this can be (partially) offset by the lower cost of cane molasses, an option of producing simultaneously with crystalline sucrose also a higher value invert-rich product for fermentation and other uses, and availability in well designed cane factories during and after the grinding season of excess bagasse to power the energy intensive ion exclusion process.

It is generally acknowledged that an optically clear liquid must be obtained prior to any "packed bed" operation, be it ion exchange or ion exclusion, if periodic backflushing of the columns and resin cleaning is to be avoided. Although wide variations can be found depending on the cane source, soil, processing conditions, etc. the cane molasses contain up to 5 % or so of "suspended solids", organic and inorganic in nature, ranging in size from colloidal particles of 0.1 - 0.5 microns to sludge consisting of particles several microns in size that, as opposed to the colloids, settle easily from diluted molasses under the force of gravity. Generally applicable limits on admissible levels of colloids (turbidity) in ion exchange applications are not available, although it has been recommended for ion-exclusion feeds to contain not more and preferably less than 100 ppm/Bx of suspended solids. In our program we have developed criteria based on the nephelometric turbidity of the dilute sugarcane molasses. As will be discussed later in more detail, it was concluded from our work that the clarification should produce liquids with turbidity below 15 NTU/Bx and, preferably, with turbidity 10 NTU/Bx or less if a danger with resin fouling is to be avoided in prolonged uninterrupted operation.

Because the sucrose - salt separation suffers with increasing content of divalent ions adsorbed on the cation exchangers commonly used in the ion exclusion plants (sucrose is less and salts simultaneously more strongly retained on divalent than monovalent form of the resin), the molasses desugarization (ion exclusion) is preferably done on ion exchangers in monovalent form (Na and K). Unfortunately, the selectivity coefficients for strong acid cation exchangers follow a sequence (Table 1) Ca > Mg > K > Na, posing a challenge in pretreating cane molasses. These typically contain between 6,000 to 14,000 ppm/Bx of Ca/Mg and this has to be reduced to no more than 2,000 ppm/Bx (our work) and as low as 300 ppm according to other authors.

Table I: Selectivity coefficients of cations on a strong acid cation exchanger with H ion as a reference.

Ca	Mg	K	Na
3.0	2.5	2.1	1.4

In our opinion the lack of an economical process for clarifying and softening the cane molasses has been the principle factor inhibiting up to now the application of the ion exclusion desugarization in the cane industry. On overview of a complete process that deals with these problems and was developed jointly at the Audubon Sugar Institute at Louisiana State University (LSU) and Applexion, Inc. is given below. The process of molasses softening, column regeneration and regenerant recovery is a subject of a patent application filed jointly by Applexion and LSU Agricultural Center.

Overview of the LSU/Applexion Process:

Primarily because of the reduced useful capacity of the softening resins at high solid concentrations, the molasses is first diluted to approximately 40 Bx in the mixing tank 1, and is then heated and clarified with the addition of a polymeric flocculent and a filter aid and filtered on the filterpress 2. The clarified molasses with turbidity 10 - 15 NTU/Bx is then fed into the softening columns 3, packed with a macroporous strong acid cation exchanger. The exiting clear molasses, now softened below 2000 ppm Ca/Mg / Bx is then concentrated in the evaporator 4 to 70 Bx and fed into the simulated moving bed (SMB) ion-exclusion separator 5.

Two principal options exist as far operating the SMB separator, and these can be chosen depending on the present marketing circumstances: either two or three fractions are produced. In the first, two-product option, the extract is produced containing the recovered sucrose (concentrated in the evaporator 7 and sent to sucrose crystallization) and a second product containing both invert and non sugars. In the second, three products generating option, besides the sucrose-rich extract, two other products are produced, the raffinate containing primarily non-sugars, and an invert product, rich in invert sugars, glucose and fructose, concentrated in the vacuum evaporator 8.

The three-product option that gives the operator increased flexibility depending on the marketing conditions may prove desirable in certain circumstances, e.g

- if there is a need, because of difficulties with crystallization, exhaustion, color formation, etc., for reducing the amount of invert sugars recirculated in the extract back to sucrose crystallization,

- if there is a demand for a high invert sugar content stream for fermentation, which is low in color, salts, heavy metals, etc.,

- if there is a demand for a high invert, low turbidity product that can further be decolorized, polished and/or demineralized for other food uses.

The soft, low Ca/Mg content raffinate from the separator 5 is first concentrated in the evaporator 6 to circa 30 Bx, and after addition of the salt recovered in the salt crystallizer 10 used to regenerate the exhausted softening columns 3. The make-up salts, chlorides of sodium or potassium are nearly fully recovered (after evaporation in 9) in the crystallizer 10 from the spent regenerant which is rich in monovalent and divalent cations. The recovered salts are then dissolved in soft raffinate (tank 11) and clarified in the tank and filterpress 12 using an analogous procedure to that used for clarifying the feed molasses. The clarified brine is then mixed with the rest of the concentrated soft raffinate and used for regeneration of the softening columns 3. At the start up, and later for the make-up if salt deficit occurs, an option exists of using either NaCl or KCl for regeneration of the softening columns. This choice will then effect the K:Na ratio in the hard raffinate (exhausted molasses) and will depend on the local availability and cost of the chlorides and the end use of the raffinate product. The inhibition of yeast fermentation at high salt levels is expected (7) and the ion-exclusion salt-invert separation as a result of the three-product option represents a competitive alternative to the three processes suggested earlier for molasses desalting: counter-diffusion, electrodialysis and ion exchange (7). The benefits are to be weighted against the estimated cost, consisting primarily of increased water use in the ion-exclusion separator, by about 25% compared with the two-product option, adding about $3.0 in steam cost per ton of 85% feed, and about 2% lower sucrose recovery in the extract product, where the 2% are recovered instead in the invert product. The latter argument may of course be inconsequential if the fermentation product (from the invert product) is of comparable value as the solid sucrose.

Molasses Clarification:

A large number of flocculants, filter aids and adsorbents were tested for their capacity to coagulate and flocculate the prevalently negatively charged colloids in the sugarcane molasses. A partial list of the tested materials is given in Table I. Most of these materials are currently in use in various industries, but are not necessarily approved for food use. Some of the cationic flocculants were found to be excellent scavengers for the molasses colloids, and effective in clarifying the molasses at the dose levels of the active polymer of 6 to 20 mg per liter of diluted molasses. The required doses are substantially higher than is usual in sugarcane juice clarification, in part probably because of the higher ionic strengths of the molasses (at the dilutions used in molasses clarification). Even more importantly perhaps, the polymer in case of our molasses clarification process acts rather as a scavenger for the colloids instead of merely flocculating the insoluble calcium precipitates as in cane juice clarification. Although the detailed mechanism has not been studied, it is likely that the cationic flocculent $F^+F^+F^+F^+F^+$ binds electrostaticaly to the colloid molecules $C^-C^-C^-$, partially desolvated and coagulated at boiling temperatures. Moreover, the large and flexible flocculent molecules, with colloids bound to them, bridge the porous particles A of the alumina silicate filter aids

$$n\,(C^-C^-C^-) + m\,(F^+F^+F^+F^+F^+) + A \dashrightarrow (CCC)_n(FFFFF)_mA$$

added to the molasses prior to clarification. The large sturdy floc can then easily be filtered out on a conventional filterpress.

The clarified molasses is an optically clear liquid with the nephelometric turbidity of 10 - 15 NTU/Bx. The information from Hach Company, the maker of the ratio nephelometric turbiditimeters, indicates a nearly color-independent and linear response of approximately 10 NTU/ppm to addition of colloidal carbon. For comparison, final sugarcane molasses clarified by ultrafiltration on 0.2, 0.45 and 1.2 micron pore size laboratory cellulose acetate discs was found to have a turbidity of circa 2, 3 and 7 NTU/Bx respectively.

Molasses Softening:

It is well known that for the divalent - univalent exchange on the cation exchanger X^-, e.g.

$$Ca^{++} + 2\ K^+X^- \dashrightarrow 2\ K^+ + X^-Ca^{++}X^-$$

the resin capacity for the divalent ions decreases strongly with the overall solution concentration. Moreover, even for the simple univalent - univalent exchange, such as

$$K^+ + Na^+X^- \dashrightarrow Na^+ + K^+X^-$$

the selectivities of the monovalent ions depend on their concentrations, even though to a lesser degree than in the divalent - univalent exchange.

It was found, that at the limit of 2000 ppm/Bx of Ca/Mg for the (mixed) feed to the ion exclusion separator, the useful softening capacity of the resin, is > 1.2 kg DS/l at the molasses concentration of 20 Bx, ca. 1.0 kg DS/l at 32 Bx and less than 0.4 kg DS/l at 60 Bx.

The total anticipated cost (Table III) of the chemicals used in the clarification and regeneration of the softening columns is between $2.3 to $5.4 per ton of 85 % feed molasses. This compares very favorably with the two pre-treatment processes discussed previously in the literature:

a) precipitation of Ca/Mg with H_3PO_4, followed by pH adjustment with caustic soda (phosphatation). The procedure and required doses, determined experimentally in our laboratory for softening of a 10,000 ppm/Bx hardness final molasses to 2,000 ppm/Bx, were acidification with 38 kg H_3PO_4 (100%) to pH of 4.0, then neutralization to pH 7.3 with 34 kg NaOH (100%) per one ton of 85% molasses (Table IV).

b) softening on a weak acid cation exchanger, regenerated with HCl and caustic soda, after a partial clarification with a horizontal decanter and vacuum filtration (Table V).

In addition to the chemical cost, the phosphatation at the acid doses that are required for softening gives up to 40 % of fine calcium phosphate precipitate on the volume of the treated molasses, that is hard to separate and desweeten. Similar is true for carbonatation, with a comparable operating cost to softening on a weak acid cation exchanger.

Table II: Effect of various commercial flocculants on clarification of 40 Bx sugarcane final molasses. All with 10 kg perlite filter aid per 1 m^3 of 40 Bx molasses.

PRODUCT NAME	MANUFACT / SUPPLIER	FORMULA	TURBIDITY REMOVED, %	DOSE g/m^3
4110(s)	ACC (Arlington Heights,IL)	PA-D$^+$AA	98.8	25
RM-10GRAS(s)	- " -	CLAY+	98.8	15,000
RM-10FR(s)	- " -	CLAY+	< 0	
RM-10CT(s)	- " -	CLAY+	69.4	1,780
RM-10A(s)	- " -	CLAY+	81.3*	1,250
RM-10A(s)	- " -	CLAY+	62.2*	1,250
RM-10SON4(s)	- " -	CLAY+	60.6*	1,250
1190(l)	BETZ (Trevose, PA)	PQA [L]	< 0	
1195(l)	- " -	PQA [M]	69.4	25
DG1882(l)	- " -	C [H]	98.8	25
DG1883(l)	- " -	C [H]	83.3	25
573C(l)	CYANAMID (Wayne, NJ)	PQA	61.2	25
577C(l)	- " -	PQA	60.5	25
573C(l) + 844A(s)	- " -	PQA+PA-D$^-$AA	69.4	50 + 25
573C(l) + 846A(s)	- " -	PQA+PA-D$^-$AA	< 0	all levels
577C(l) + 844A(s)	- " -	PQA+PA-D$^-$AA	65.0	500 + 15
581C(l) + 866A(s)	- " -	PQA+PA-D$^-$AA	69.4	9 + 24
573C(l) + 7768(l)	CYANAMID/NALCO	PQA + A	69.5	50 + 25
573C(l) + 7415SC(l)	- " -	PQA + A	73.2	50 + 15
ZUCAT406(s)	IBF (San Francisco)	PA-D$^+$AA [H]	98.8	25
COLORGONE M(l)	- " -		63.2	25
7415SC(l)	NALCO (Oak Brook, IL)	A [L]	56.0	25
7768(l)	- " -	A [L]	60.5	25
PA(s)	POLYSCIENCES (Warrington, PA)	PA, MW 600,000	47.8	25
PAA(s)	- " -	PAA, MW 200,000	69.5	25
2530(s)	STOCKHAUSEN (Greensboro, NC)	PA-D$^-$AA[H]	74.0	25
2515(s)	- " -	PA-D$^-$AA[L]	60.2	25
2273TR(s)	- " -	PA-D$^-$AA[M]	74.1	25

Table II: continued

2200(l)	TRIDENT (Baton Rouge,LA)	C [H]	63.1	25
2100(l)	- " -	C [H]	61.0	25
9050(l)	- " -	C[H]	59.1	25
WYO-BEN(s)	WYO-BEN (Billings, Montana)	CLAY	< 0	all range

Abbreviations:

A	anionic
ACC	American Colloid company
C	cationic
H	high molecular weight
IBF	Integrated Biological Farming
l	liquid or emulsion
L	low molecular weight
M	medium molecular weight
PA	polyacrylamide
PAA	polyacrylic acid
PA-AA	copolymer of polyacrylamide and acrylic acid
PA-D^+AA	copolymer of polyacrylamide and a cationic derivative of acrylic acid
PA-D^-AA	copolymer of polyacrylamide and an anionic derivative of acrylic acid
PQA	polyquaternary amine
s	solid
+	mixture of bentonite clay, flocculants, organic acids, etc.

Table III: Anticipated chemical use and cost for the clarification and softening of sugarcane molasses.

ITEM	KG/T 85% MOLASSES	$/KG	$/T 85% MOLASSES
FLOCCULENT	0.03 - 0.05	5.5	0.2 - 0.3
FILTER AID	5.0 - 10.0	0.21	1.1 - 2.1
NaCl	10 - 30	0.1	1.0 - 3.0

Table IV: Anticipated chemical use and cost for clarification, and softening of a 10,000 ppm/Bx hardness sugarcane molasses with phosphatation.

ITEM	KG/T 85 % MOLASSES	$/KG	$/T 85% MOLASSES
H_3PO_4	38	0.66	25.1
NaOH	34	0.58	19.7

Table V: Anticipated chemical use and cost for softening of a 10,000 ppm/Bx hardness sugarcane molasses on a weak acid cation exchanger.

ITEM	KG/T 85 % MOLASSES	$/KG	$/T 85% MOLASSES
HCl	17	0.21	3.6
NaOH	18	0.58	10.4

The regeneration in the LSU/Applexion process of the strong cation exchanger in the softening columns is accomplished with soft raffinate, rich on its own in monovalent ions, to which the recovered salt and make-up salt (if any is needed) is added in the amount (per one regeneration cycle) of 100 kg per 1 m^3 of softening bed volume. A sodium balance for the pretreatment, ion-exclusion separator, softening and regeneration and salt recovery is given in Table VI. The feed molasses (a "B" sugarcane molasses with about 6,400 ppm/Bx of Ca/Mg, was softened, after clarification, to 1,580 ppm/Bx hardness, in this case on a Na-form macroporous strong acid cation exchanger (Rohm and Haas, IRA 200), bringing the sodium content to 2.5 %Bx or 6.3 %Bx of NaCl (calculated from the Na concentration assuming that all sodium is in the form of a chloride). After a three-product separation, make-up NaCl was added to raise NaCl concentration from 29.2 to 45.2 %Bx. The raffinate/NaCl solution (line 4 in Table VI) was then used to regenerate the spent softening columns, giving a diluted hard raffinate (line 5) with 38.1 %Bx NaCl and 0.72 %Bx of Ca/Mg. To study the NaCl recovery, the hard raffinate was then concentrated to mother-liquor concentrations of between 62 and 75 Bx (massecuite Bx of 66 to 82) under vacuum at 65 oC. The 100 - 300 micron NaCl crystals are then easily separated from the relatively low
viscosity massecuites with a Nutch bomb. The NaCl recovery reaches about 98 % (of the amount added to the soft raffinate) at 75.1 Bx mother-liquor concentration, and exceeds 100% at even higher concentrations. With no washing, the crystal purity ranges from 70 to 76 % depending on the mother liquor concentration and presumably on the amount of mother liquor adhering to the crystals. NaCl crystals are then dissolved in either water or dilute soft raffinate to give brine of around 30 %DS, which is somewhat turbid presumably because of some polymerization/aggregation at the high
salinity levels and overall concentrations prevailing in the NaCl crystallization, and needs to be reclarified before used as a fresh

Table VI: Sodium balance and the NaCL recovery from the spent regenerant. A sugarcane "B" molasses was softened on a Na form of a strong acid cation exchanger (Rohm and Haas, IRA 200).

	Sample		Bx	Na %Bx	NaCl %Bx	Ca/Mg ppm/Bx
3	FEED MOLASSES		68.6	0.3	0.6	6,390
2	PRETREATED MOLASSES		70.0	2.5	6.3	1,580
3	SOFT RAFFINATE		30.9	11.5	29.2	9,630
4	SOFT RAFFINATE / NaCl		37.9	17.8	45.2	2,360
5	HARD RAFFINATE		5.0	15.0	38.1	7,160
6	Mother Liquor 1		61.7	11.0	27.9	9,630
7	2		65.7	9.4	23.9	8,780
8	3		71.3	8.1	20.6	10,010
9	4		75.1	7.7	19.6	9,650
		NaCl Recovery %	%DS	Na %DS	NaCl %DS	Ca/Mg ppm/DS
10	Crystal 1	57		36.0	76.2	2,030
11	2	74		29.2	74.1	2,140
12	3	90		28.3	71.9	2,570
13	4	98		27.7	70.3	3,030
14	Clarified Brine 1		28.3	36.1	91.7	2,500
15	2		27.4	36.1	91.7	2,540
16	3		29.2	35.2	89.4	3,030
17	4		30.3	35.3	89.6	3,040

regenerant on the molasses softening columns. The brine clarification is easily accomplished using the same process as the clarification of the molasses, at somewhat lower dose of the flocculent and filter aid.

The high concentration run-off from the salt crystallization, is then disposed of as the exhausted molasses, and because it has been crystallized, is unlikely to develop spontaneous salt crystallization later in storage, as is the case with conventional sugarbeet raffinates.

Ion-Exclusion Separator:

The separator consist of eight columns connected in series into which clarified, softened molasses and water are continuously pumped, and three (or two) products continuously withdrawn. By periodic switching of the inlet and outlet ports a countercurrent movement is simulated of the resin bed against the direction of the liquid flow. The design considerations involve size and dimension of the columns, location of the inlet and outlet ports (that define the length of the zones, I, II, III, IV and V, that is the regions of the system with the same flow rate), and choice of the feed, water, recycle, extract and invert flow rates.

Clearly, the average velocities u (cm/min) of sucrose (S) and non-sugars (NS), related to the interstitial fluid velocity v in that zone, the packed bed resin/liquid ratio f = (1-e)/e (e, the void fraction), and their (composition dependent) distribution coefficients K, as

$$u_i = v / (1 + f K_i)$$

must conform to

$$u_S(II) < u_{NS}(III)$$

and

$$\frac{v(III) + v(FEED)}{1 + f K_S} < \frac{v(III)}{1 + f K_{NS}}$$

for any separation to be possible between sucrose and non-sugars in the fractionation zones II and III. Further, since

$$v(III) = v(I) + v(WATER) - v(INV) - v(EXTR)$$

it is easy from reference to the latter od the two inequalities, to infer some general guidelines for SMB design:

- maximize the difference between $K_S - K_{NS}$ by proper resin selection. This is obvious for linear components, but more involved in reality since both K's, but mainly K_{NS} depend on the system loading.

- minimize feed volume F (v(FEED) = F/Ae, where A is the column cross section). This is equivalent, if we keep the load on the system in kg DS/m^3 resin/day constant, to maximizing the feed concentration.

- maximize the recycle rate v(I).

The last is of course subject to constraints, posed by the increased pressure drops in the columns, energy requirements and increase in HETP (band broadening) of the sugars at high flow rates from limitations due to restricted diffusion of the sugars within the resin.

The design is greatly facilitated with use of computer models. In our work a staged, finite difference, local equilibrium model was developed, validated and found adequate to predict effects of various design variables on the separator performance. The partition coefficients K of the major components (sucrose, non-sugars, colorants, invert, etc.) and their HETP's are found preferably by pulse testing at various flow rates as discussed by us recently.

Table VII: Composition of the products. Feed: a 70 Bx clarified, and softened sugarcane "B" molasses.

Product	Bx	Sucrose	NS	Invert	Color ICUMSA 420 nm	Ca/Mg ppm /Bx
		% Brix				
Feed	70.0	62.5	25.7	11.8	77,400	1,580
Extract	27.0	89.3	3.8	6.9	15,200	40
Raffinate	4.1	14.9	79.2	5.9	251,500	1,620
Invert	4.0	9.4	26.8	63.8	78,100	1,010

Table VIII: Composition of the products. Feed: a clarified and partially softened sugarcane "C" molasses at 70 Bx.

Product	Bx	Sucrose	NS	Invert	Color ICUMSA 420 nm	Ca/Mg ppm/Bx
		% Brix				
Feed	70.0	45.8	42.5	11.7	130,300	4160
Extract	28.2	75.9	18.0	6.1	46,600	740
Raffinate	5.1	6.0	88.2	5.8	301,900	2250
Invert	4.9	4.6	35.7	59.7	65,300	220

An example of product compositions from tests with "B" and "C" sugarcane molasses is given in Table VII and VIII, with an average sucrose recovery in extract of 90%, sucrose recovery in the invert product of 2%, invert (glucose/fructose) recovery in extract of 30% and invert sugar recovery in the invert product of 60 %. Because the run-off from the extract crystallization will likely be recirculated, i.e. mixed and desugarized with the feed molasses, the overall recovery of the invert sugars (in the invert product) will likewise be around 90%. The color (420nm) of the sugar produced in our 20 liter vacuum pan from the extract from Table VII (feed: sugarcane "B" molasses) was 440 ICUMSA units.

Conclusions:

The process described here for desugarization of sugarcane molasses has been designed to minimize the use of chemicals and the associated acquisition and disposal costs. It is anticipated that 90 % of the incoming sucrose in the feed molasses will be recovered as a low color crystalline sucrose, while 90% of the invert sugars will be recovered in a relatively salt free liquid product well suited for high value fermentations and, after possibly some additional polishing for other food uses. As with other emerging technologies, particularly those in the sugar business, the economic viability of this process depends heavily on other than free market forces. The current situation in the United States appears to favor adoption of a cane molasses desugarization process by the industry.

THE YSI 2700 SELECT FOR SUGAR ANALYSIS

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Enzyme based sugar analyzers have been on the market for a number of years. They have found application primarily in the clinical area. Because this type of instrument offers great potential for simplifying sugar analysis an inter-laboratory study was undertaken to determine the repeatability of analysis of the newest generation of this class of instrument. The Yellow Springs Instrument Co., Inc (YSI) Model 2700 Select biochemistry analyzer is the latest in a series of immobilized enzyme based sugar analyzers. This instrument rapidly measures analytes and requires little or no sample preparation. As a class, these instruments have been previously studied for potential use in the sugar factory analytical laboratory (3). This specific instrument is making some inroads into the cane sugar industry and is currently a major analytical tool in the factory laboratory of a US sugar producer (1). The interest of the sugar industry in this analyzer lies in its ability to directly measure sucrose and glucose. The Model 2700 Select does not analyze for fructose. In order to determine the repeatability of analyses of raw sugar and final molasses a comparative inter-laboratory study was conducted.

Methods:

Participating Laboratories: - Four laboratories participated in this study. They were: [1] The Audubon Sugar Institute, Louisiana State University Agricultural Experiment Station, Baton Rouge, La. [2]. The USDA Sugar Cane Research Laboratory, Houma, La., [3] the US Sugar Corporation Factory Laboratory, Clewiston, Fla. and [4] the Institute fur Landwirtshaftliche Technologie und Zukerindustrie, Braunschweig, Germany.

Procedure - Identically equipped instruments were supplied to the participating laboratories, courtesy of YSI. Eight final molasses samples and seven raw sugar samples, obtained from Louisiana sugar mills, were tested. These samples were analyzed by traditional methods, HPLC and YSI 2700 Select before being distributed to the various laboratories. YSI Analysis was conducted according to manufacturer's directions. The parameters for setting up the Model 2700 Select were sent to each of the participating laboratories along with the samples. Each analysis was repeated five times. Brix determinations were conducted by refractometry.

Sample Preparation:Procedures (As distributed to participating laboratories)

Molasses: Prepare a 1:1 dilution by weight. Then weigh 10.0 gms of this molasses/ water dilution into a 100 ml volumetric flask and dilute to 100 ml with water. Prepare triplicates of this final dilution.

Sugar: Dissolve 2.5 gms of raw sugar in water and make up to volume with water in a 100 ml volumetric flask . Prepare triplicates.

Statistical Evaluation. "Given *kn* experimental units that can be grouped into *n* blocks of *k* units each in such a way that the responses of the units within a block may be expected to be more homogenous than those of units taken from *different* blocks, we may use a *randomized complete block* design for an experiment involving *k* treatments". (5) .

There is a common source for each of the final molasses and raw sugars. Each sample was mixed and subdivided into four parts. Each batch of molasses or sugar can be considered as a block. We assume homogeneity within a batch of molasses or sugar but not across batches of molasses or sugar. Triplicate dilutions were made of each subsample for analysis and five readings were taken on each triplicate. Therefore we had fifteen readings per sample per laboratory. The average of these fifteen readings was calculated to give one value per sample per laboratory for statistical analysis.

Our primary interest was in detecting differences in measurement between the four laboratories so each lab was used as a fixed effect treatment and the hypothesis was

H_0: u1 = u2 = u3 = u4

H1: not H0

where u1, u2, u3, and u4 were the values of each of the four laboratories respectively.

The alpha value, the standard by which one accepts or rejects the hypothesis H_0 is 0.05. If we rejected H_0 in favor of H_1 we used the Bonferroni pairwise comparison to avoid inflation of Type 1 error, to evaluate the results of the laboratories. As we had at least six comparisons an alpha value of 0.01 was conservative. If the P value (which indicates the strength of significance) was > alpha (0.01) then we concluded

Mean of Lab(i) = Mean of Lab(j)

where lab i and j are different laboratories. However if the P value was < alpha (0.01) then the values were not equivalent.

Additional calculations were made to obtain the reproducibility and repeatibilty parameters. Variance and maximum tolerable differences (reproducibility value and repeatibilty value) are as defined by Horwitz (4). The following symbols are used: repeatibility (sr), reproducibility (sR), repeatibilty value (r = 2.8 x sr), reproducibilty value (R = 2.8 x sR).

Results and Discussion:

Comparison of Methods

The samples utilized in this study were first analyzed by the YSI Model 2700 Select and the values were compared to HPLC (6) and pol values. Pol analysis was conducted by the lead substitution method (2). The P values for sucrose analysis showed an equivalence of method for raw sugar analysis but not for molasses analysis (Table 1).

Table 1

P VALUES
Sucrose in Sugar and Molasses, Different Methods

	Sugar	Molasses	Sugar	Molasses
Method	**Pol**		**HPLC**	
Pol	-	-	0.5519	0.001
YSI	0.1228	0.0001	0.3153	0.0076

P = strength of significance, a P > 0.05 indicates equivalence

Pol analysis of the test samples was used as the basis for comparison with the YSI analysis.

Sucrose Analysis by YSI

Two of the four reporting laboratories reported values for sucrose standards with a variation greater than 5%, even though all other instrument parameters were correct. Therefore, sucrose values reported by these laboratories were corrected according to the equivalent standard values obtained from the other laboratories. The averages of each set of fifteen readings were used to calculate means. A summary of the means and variations for raw sugar are given in Table 2 and for molasses in Table 3.

Table 2

Sucrose (%) In Raw Cane Sugar

	A	B	C	D	E	F	G
Mean	97.35	97.04	96.00	98.10	96.38	97.12	96.66
s_r	1.03	0.62	1.00	1.04	1.90	1.35	0.78
s_R	2.30	2.82	2.26	3.90	4.31	4.01	3.23
r	2.88	1.74	2.80	2.88	5.32	3.78	2.18
R	6.44	7.90	6.33	10.90	12.07	11.23	9.04

Symbols: repeatability (s_r), reproducibility (s_R), repeatability value ($r = 2.8 \times s_r$) reproducibility value ($R = 2.8 \times s_R$).

Table 3

Sucrose (%) In Cane Molasses

	A	B	C	D	E	F	G	H
Mean	35.20	35.86	30.89	30.70	32.56	30.89	32.20	34.7
s_r	0.40	0.52	0.58	0.58	0.47	0.32	0.45	0.45
s_R	2.05	0.62	1.31	0.86	0.72	0.63	1.02	0.98
r	1.12	1.46	1.62	1.62	1.32	0.90	1.26	1.26
R	5.74	1.74	3.67	2.41	2.02	1.76	2.90	2.74

Symbols: repeatability (s_r), reproducibility (s_R), repeatability value ($r = 2.8 \times s_r$) reproducibility value ($R = 2.8 \times s_R$).

The repeatability of sucrose analysis in raw sugar ranged from 1.79 to 5.51% and the reproducibility ranged from 6.59 to 12.52 %. The repeatability for sucrose analysis in molasses ranged from 2.91 to 5.27 % and the reproducibility ranged from 4.85 to 16.3 %. The matrices of P values for analysis of sucrose in sugar and molasses are given in Table 4. The sucrose values in final molasses, as measured between laboratories, are equivalent.

Table 4

P Values (Sugar and Molasses)
Inter-laboratory Variance

	Molasses	Sugar	Molasses	Sugar	Molasses	Sugar
Lab	**2**		**3**		**4**	
1	0.5285	0.0117	0.1137	0.6435	0.2248	0.0001
2			0.0324	0.0042	0.0724	0.0640
3					0.6932	0.0001

Conclusions:

The repeatability of the YSI 2700 Select falls within the 5% range quoted by the manufacturer for sucrose analysis in both sugar and molasses. However, the inter-laboratory variance was well above the 5% level producing an unacceptable level of reproducibility for analysis of the sample materials. There did not seem to be any significant difference in the ability of the instrument to handle either raw sugar or molasses samples. Given the ease of use of this instrument and the repeatability of analysis in the laboratory it promises to be an excellent instrument for factory control.

Because of the low reproducibility it should not be used where financial (payment) transactions are involved.

Acknowledgments:

We would like to acknowledge the assistance of Dr. E. Aguirre, Dr. B. Legendre and Dr. K. Buchholz who helped to make this study possible

References:

1. Aguirre, E. and E. C. Watson 1992. Use of Immobilized-Enzyme Electrode for Sugar Analysis. Presented at the 22nd Annual Joint Meeting of the American society of Sugar Cane Technologists. St. Augustine, Fla. June 17-19.

2. Clarke, S. and J. Bourgeois. 1990. A simple and safe replacement for lead subacetate for juice clarification. International Sugar Journal, 92: 35.

3. Day, D.F.and D. Sarkar. 1985. The glucose electrode and its use in the sugar mill laboratory. J of the ASSCT, 6: 102-107.

4. Horwitz, William. 1990. "Protocol for the design, conduct and interpretation of collaborative studies". IN International Commission for Uniform Methods of Sugar Analysis. Report of the the Proceedings of the Twentieth Session. British Sugar Technical Center, Norwich, England. 146-158.

5. Huntsberger, David and Patrick Billingsley. 1981 Elements of Statistical Inference. 5th Edition, Allyn and Bacon, Boston. pp 432-437.

6. Saska, M. 1989. Composition of the 1988 Louisiana Final Molasses. Sugar Journal, Oct.: 13-15.

DEXTRAN SURVEY 1992

Durriya Sarkar

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The 1992 dextran survey is for Louisiana Sugar Mills reporting daily dextran data on sugar analyzed by the Haze method. I also received dextran data on juice samples done by the ASI II method from Iberia Sugar Cooperative. The sugar dextran showed a pattern similar to that of the core juice dextran.

Figure 1. Shows the daily average dextran in sugar for the mills. The four periods marked show the times when the dextran was above penalty level (250 MAU). As we have noticed in the past six years the dextran level goes up when it rains and the low temperature exceeds 50°F.

Figure 2. The daily average rainfall in inches for the season with four periods marked when dextran was above penalty level. Although there was some rainfall at other times dextran was not a problem as temperatures were low.

Figure 3. The average low temperature for the season with the shaded areas showing temperatures above 50°F accompanied by rain when dextran was above penalty level.

Figure 4. Average high and low temperatures recorded for the season show a lot of fluctuations.

Figure 5. Average dextran in sugar for the mills in the Teche region, shows a graph almost similar to that of the average for all the mills (Figure 1).

Figure 6. Average dextran in sugar for the mills in the Bayou Lafourche area. This also shows the four periods of high dextran similar to the average.

Figure 7. Average dextran in sugar for the mills in the Mississipi area.

Figure 8. A bar graph showing the number of days above penalty level for sugar dextran for each of the mills participating in the survey.

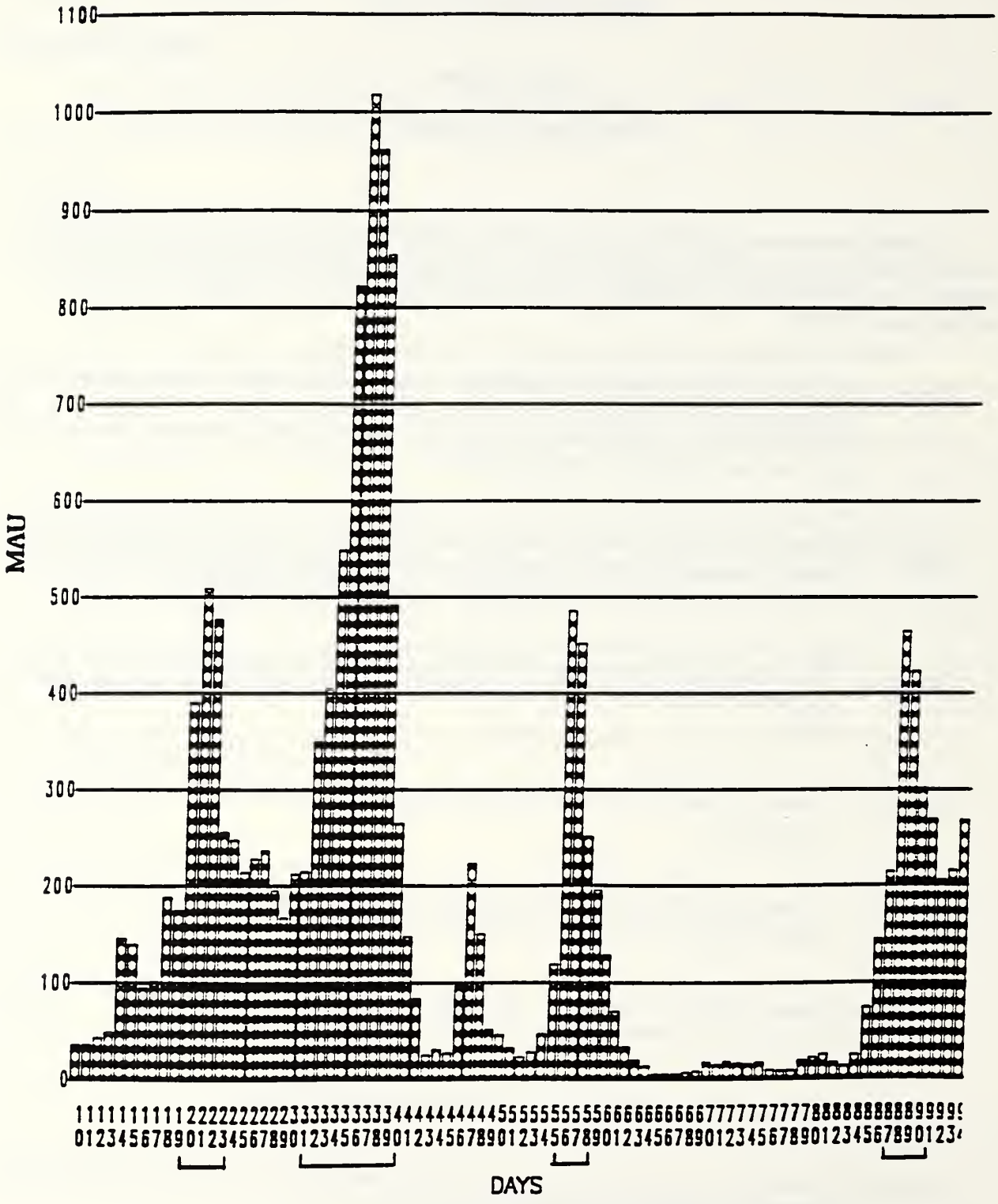


FIGURE 1. AVERAGE DEXTRAN FOR THE SUGAR MILLS

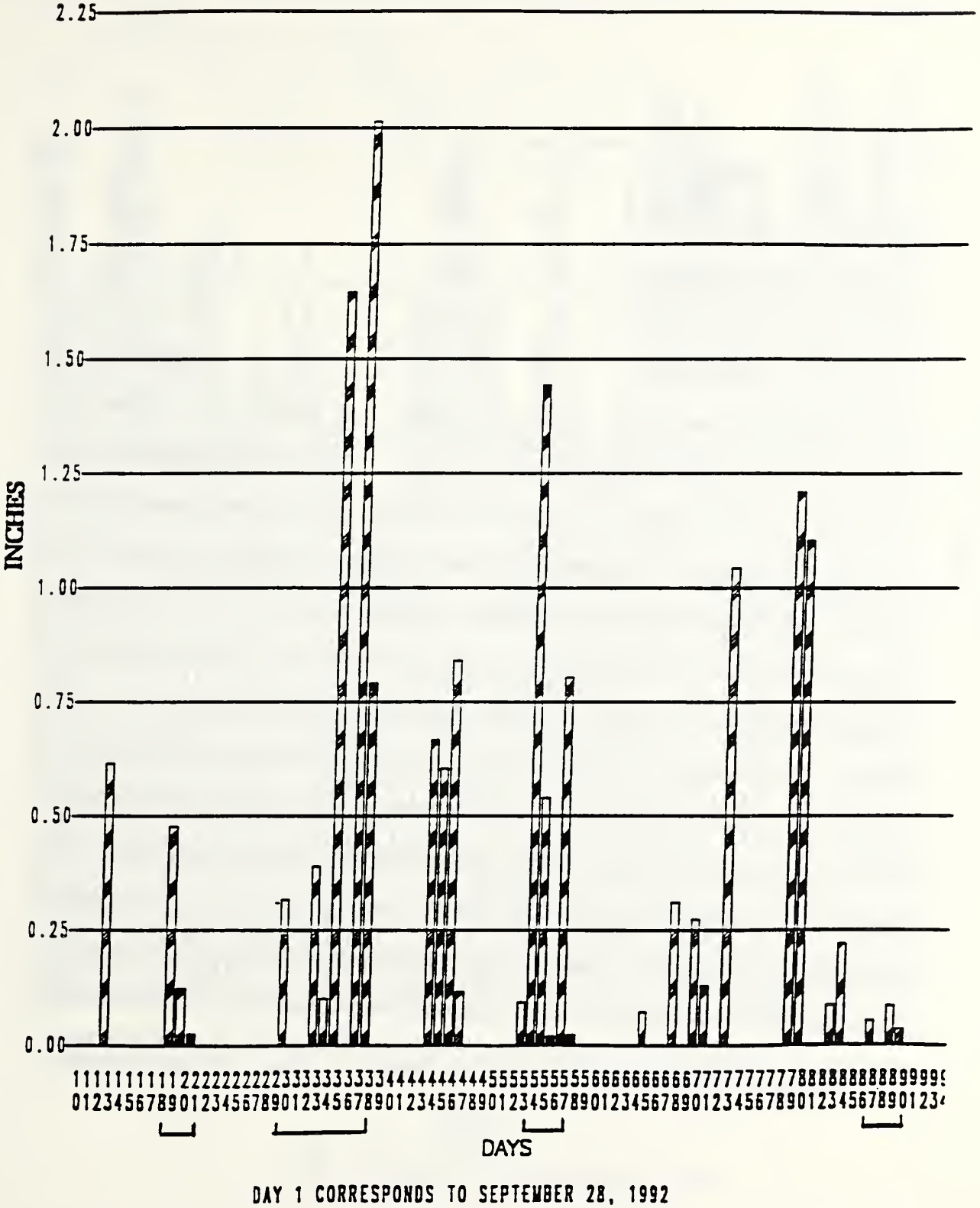
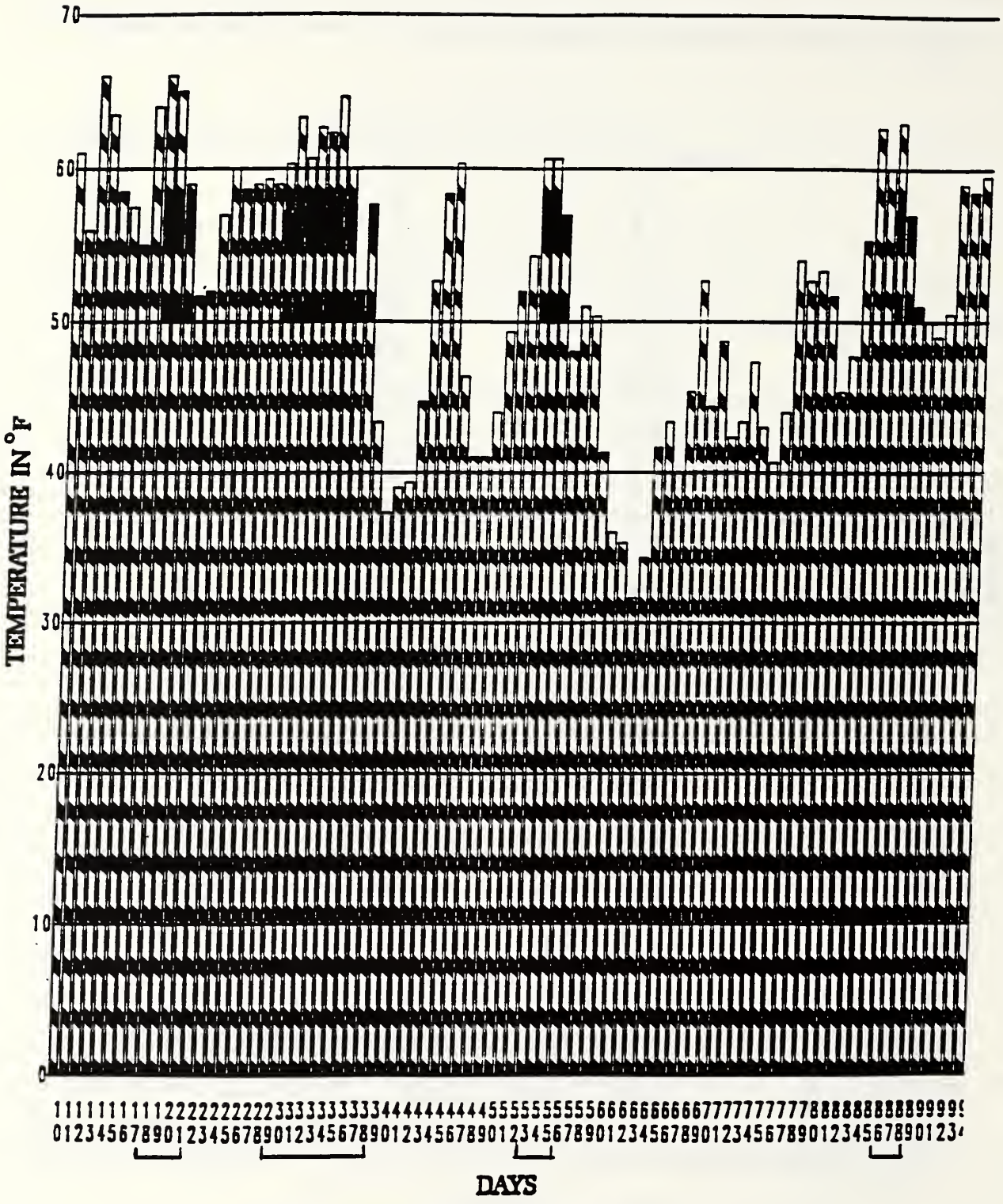


FIGURE 2. AVERAGE RAINFALL



DAY 1 CORRESPONDS TO SEPTEMBER 28, 1992

FIGURE 3. AVERAGE LOW TEMPERATURE

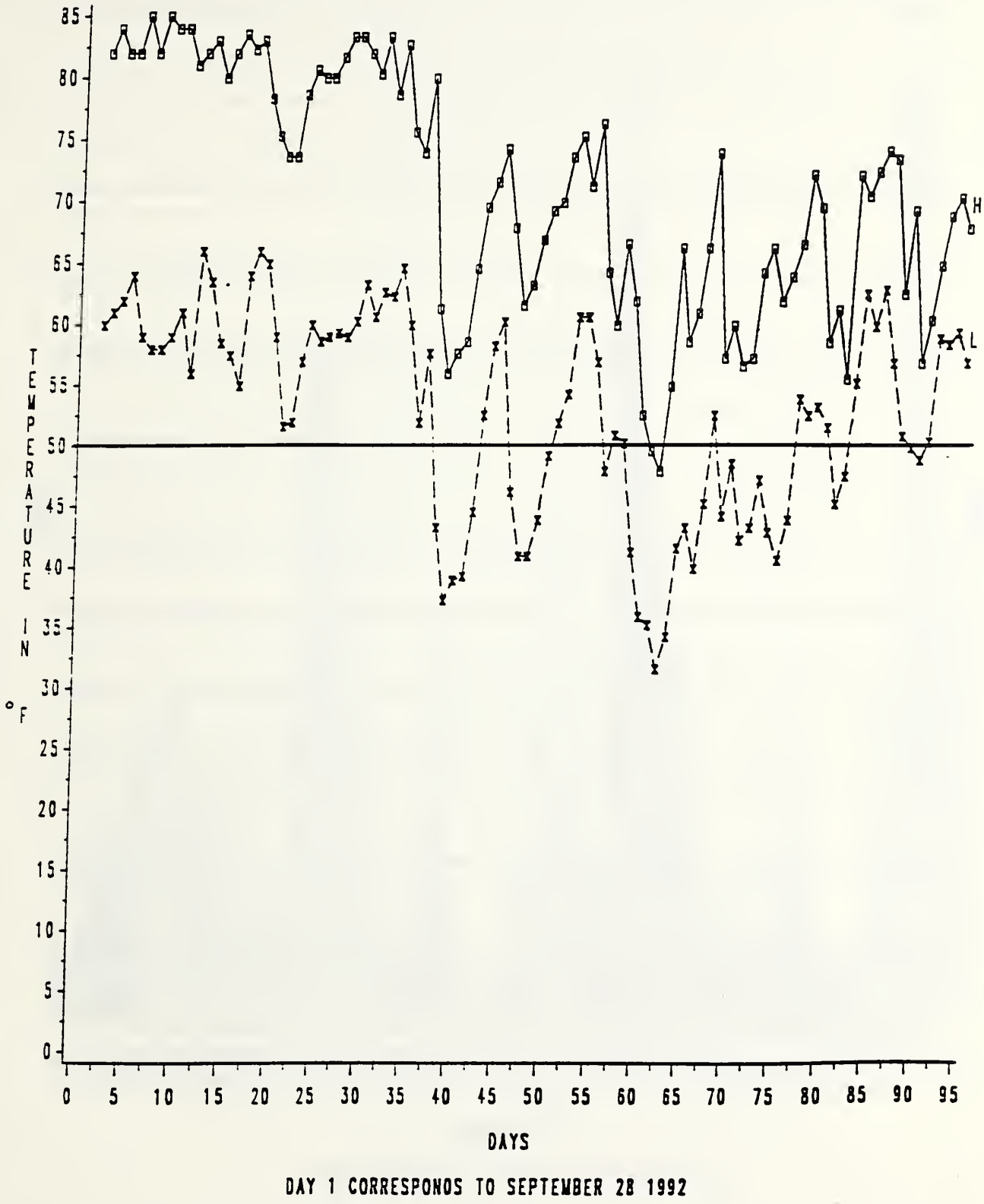


FIGURE 4. AVERAGE HIGH AND LOW TEMPERATURE

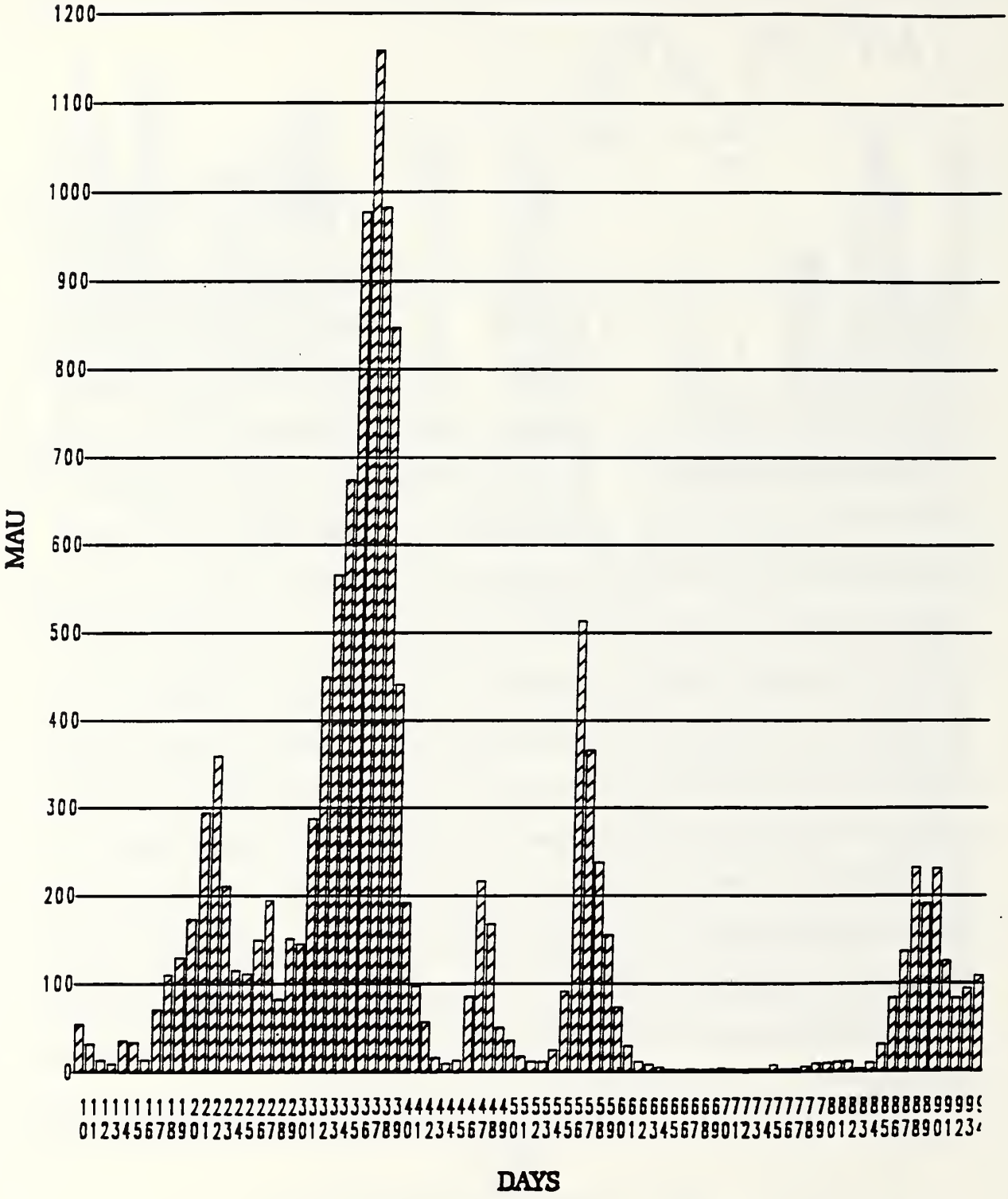


FIGURE 5. AVERAGE DEXTRAN FOR THE TECHE REGION

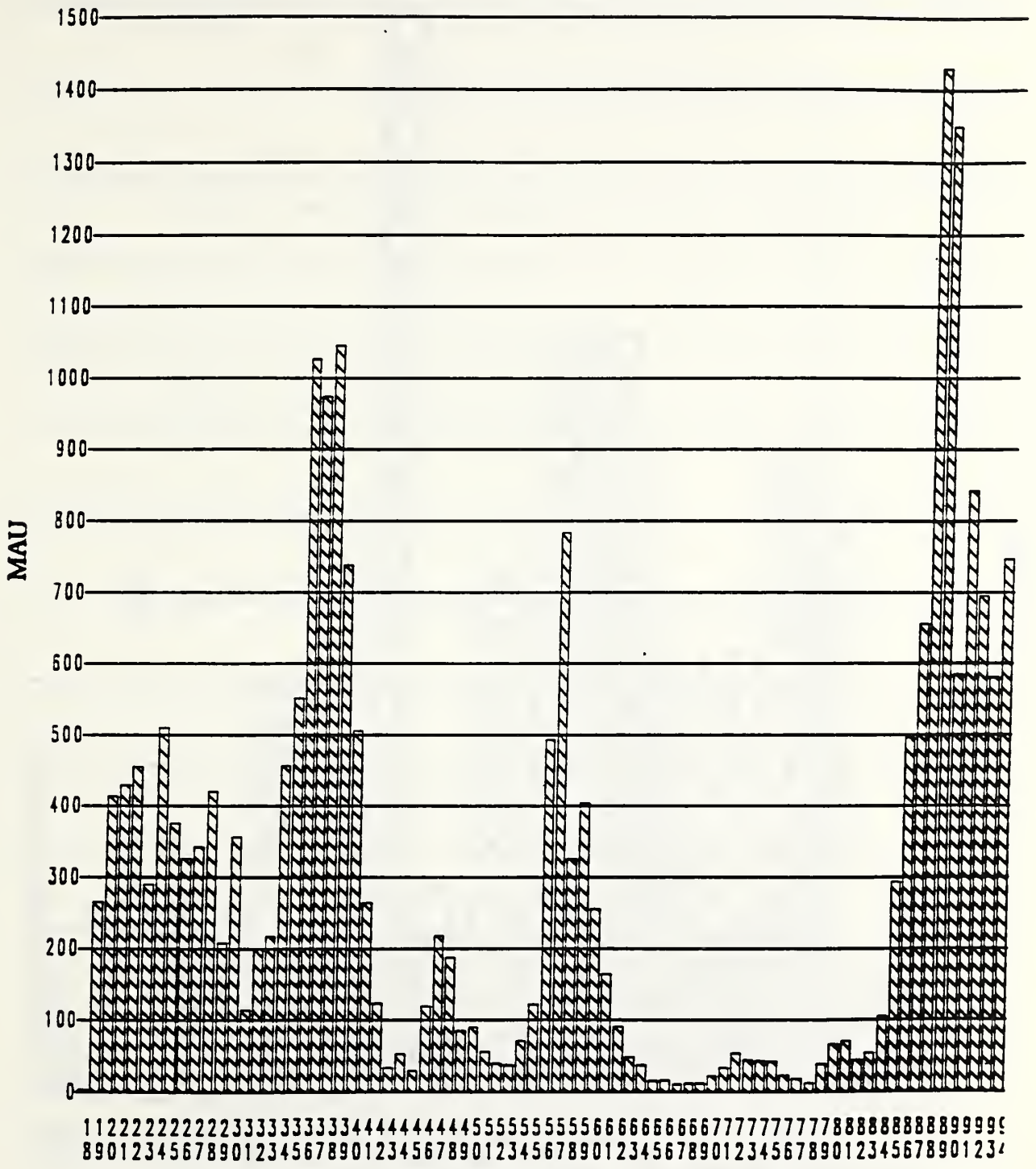


FIGURE 6. AVERAGE DEXTRAN FOR THE BAYOU REGION

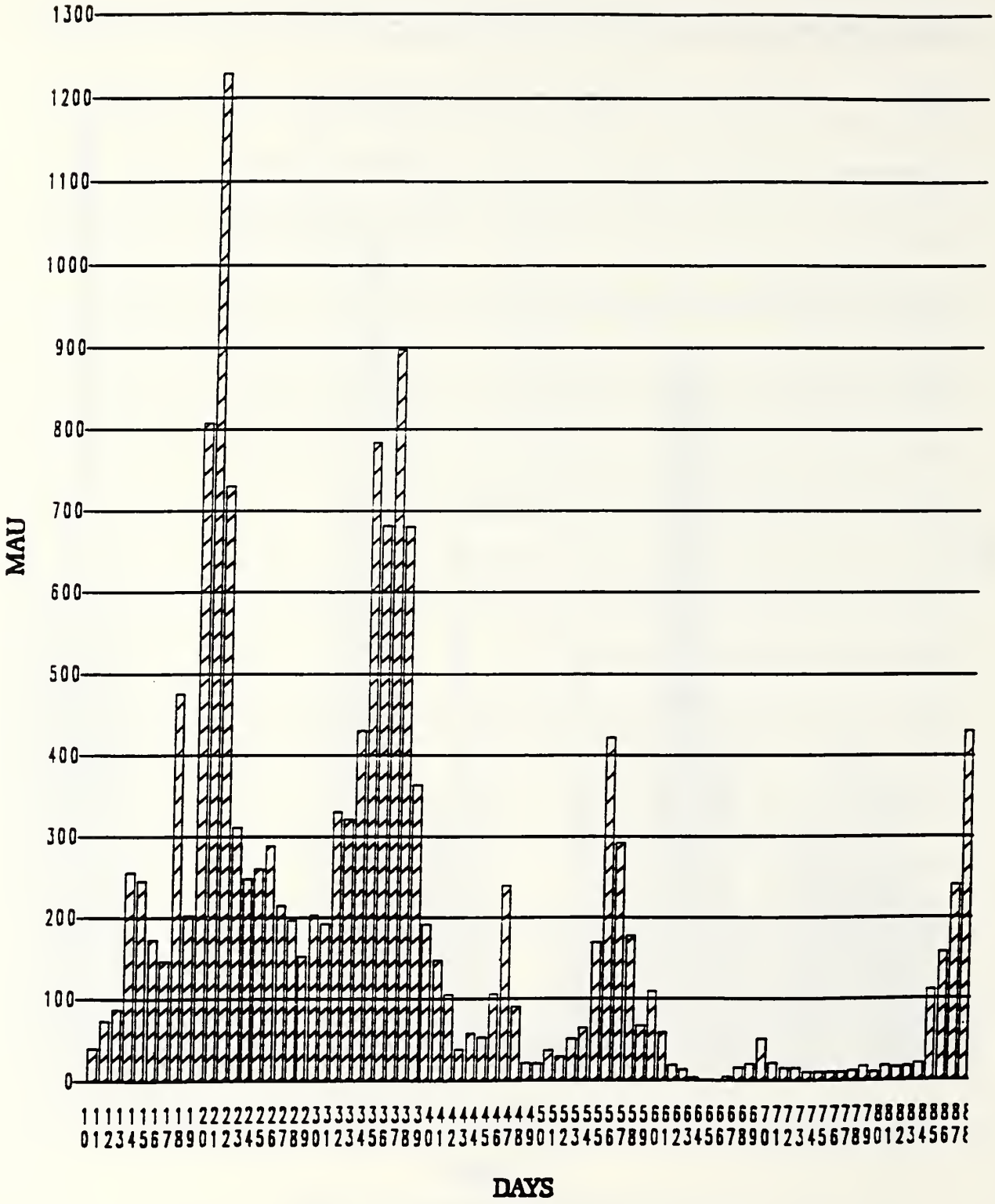


FIGURE 7. AVERAGE DEXTRAN FOR THE MISSISSIPI REGION

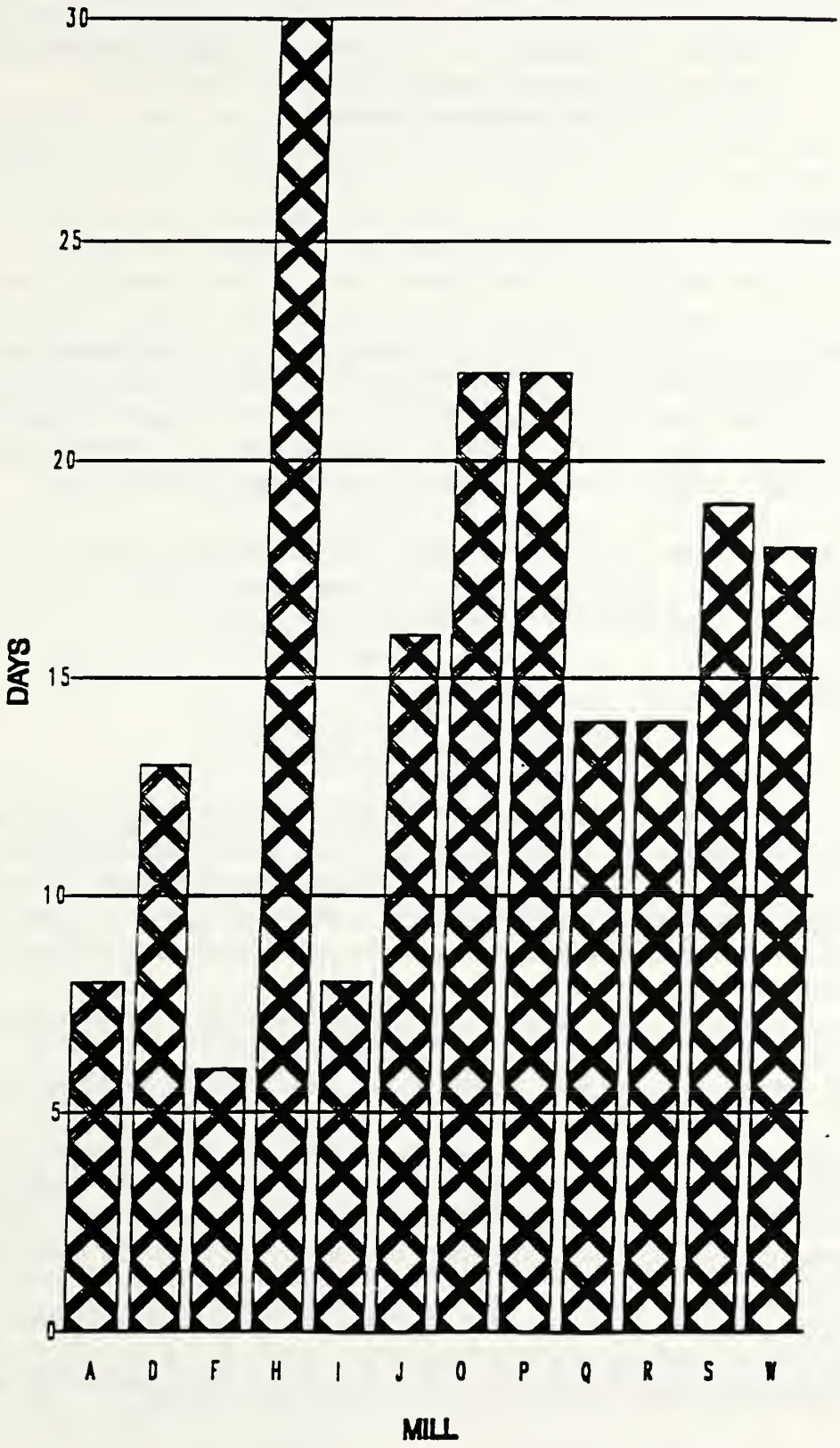


FIGURE 8. DAYS ABOVE PENALTY LEVEL FOR SUGAR DEXTRAN

SUGARCANE WASH WATER TREATMENT SYSTEMS

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INTRODUCTION:

Since the project started in 1989, the research work has been focusing on the sugarcane wash water treatment systems of the wash pond systems in Leighton Factory, Glenwood Factory and Cora Texas Factory, and on the diked natural wetland system in Lula Factory. In 1992, the research work proceeded with the studies and results in the previous years. The systems were monitored, water quality data were documented, some design and management guidelines were derived and some kinetic models were developed. Experiment on anaerobic process applied to sugarcane wash water treatment was conducted in the early months of this year.

Three masters theses have been completed. One article was published in the Sugar Journal (November 1992) on the Leighton Factory wash pond system, and one article is completed and will be submitted to the Sugar Technologists Journal.

RESEARCH PROGRESS:

Wash Pond Treatment Systems

Based on two years of research work on the Leighton wash pond system which led to considerable improvements to one particular sugarcane wash water treatment system, a masters thesis was completed by C. W. Sutherland. Some important recommendations for improving the system were made in the study to control the odor and pH problems with the operation of the ponds. Through monitoring the modified pond system in 1991-1992 season (October 1991 - June 1992), the conclusions were:

* Implementation of the 1991 design modifications to the wash pond system proved to be very successful in eliminating odor and in maintaining pH;
* The new configuration decreased the active wash water pond volume during milling from 8.3 to 1.6 million cubic feet of water;
* It decreased the retention time from 4.3 to 0.9 days while increasing the BOD_5 concentration to a maximum of roughly 5000 mg/L at the end of the milling season;
* With the concentrated arrangement of aerators in a smaller aeration pond, the circulated wash water can pick up more oxygen from both aeration area and the wash table during each cycle;
* The oxygen supplied to the water was successful in maintaining facultative conditions with an average dissolved oxygen content above 2 mg/L during the milling season;
* The facultative conditions were achieved to reduce the formation of fatty acids, and

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therefore, to maintain an average pH of 7 or greater; and

* The high DO level along with the higher pH also reduced the formation of hydrogen sulfide to minimize odor.

After finishing the monitoring and data analyses on the Leighton pond system from October 1991 to June 1992, a masters thesis was completed by Y. G. Zhang. The performance of the modified system was evaluated. Three phases of the eight month treatment period of the wash pond system and their characteristics were identified (Table 1). For each of the three phases a kinetic model was successfully developed to describe the BOD changes in the treatment process.

Table 1 Operational Phases and Characteristics of Wash Pond System in 1991-1992

Phase	Period	Characteristics	Water Quality (effluent)
Phase I	Oct. 9, 1991- Dec. 1, 1991 53 days	Cane processing season started; Full organic loading was at wash table; Wash water was recirculated by pump; Wash water was aerated in aeration pond; Solids were removed in settling pond; and Lime was added.	BOD_5 avg. 1982 mg/L COD avg. 3552 mg/L pH avg. 7.30 TSS avg. 505 mg/L TVSS avg. 235 mg/L
Phase II	Dec. 2, 1991- Jan. 24, 1992 54 days	Cane processing season ended; No organic loading was added to system; Wash water was recirculated by pump; Wash water was aerated in aeration pond; Solids were removed in settling pond; and No lime was added.	BOD_5 avg. 2689 mg/L COD avg. 3427 mg/L pH avg. 7.39 TSS avg. 292 mg/L TVSS avg. 213 mg/L
Phase III	Jan. 25, 1992- Jun. 3, 1992 131 days	No organic loading was added to system; No water was recirculated; Wash water was occasionally aerated; No lime was added; and Settling pond was emptied for sludge removal.	At the end: BOD_5 9 mg/L COD 67 mg/L pH 8.28 TSS 16 mg/L TVSS 14 mg/L

The conclusions drawn from the studies were:

* The modified wash pond system with concentrated aerator arrangement and smaller aeration pond volume could save a large area of land;
* Odor emission could be controlled by offering proper aeration strength to maintain a facultative condition of the ponds;
* Well mixed, aerated pond wastes enhanced aerobic biological activities in the pond so that the biodegradation process of organic matter could be faster than that in an anaerobic process;
* A settling pond was necessary ahead of the aeration pond to remove solids and to condition the wastes with uneven qualities due to uneven wash operation at the wash table;
* The lime addition could improve pH control and eliminate the corrosion problem, but it could be more effective and economical if supplemental lime addition could be provided at the end of the aeration pond;
* The water quality characterized by BOD_5, TSS, DO and pH could meet the DEQ

discharge standards around the end of May; and

* The aeration pond volume could be reduced further, resulting in even higher BOD_5 concentration at the end of the milling season, but still providing good water quality before the start of the next season.

The wash pond treatment systems in Glenwood Factory and Cora Texas Factory are monitored from October 1992 and the data collection will be continued until the water quality can meet the DEQ discharge standards. Some facts of these two wash pond systems and the system at Leighton Factory are listed in Table 2.

Table 2 Comparison of Three Wash Pond Systems

	Leighton (1991)	Glenwood (1992)	Cora Texas (1992)
Operation Time (days)	53	65	79
Cane Processed (Ton/day)	7331	5100	9011
Volume of Pond Settling (cu.ft.)	720,000	1,584,000	1,675,000
Aeration (cu.ft.)	1,440,000	1,248,000	656,000
Flowrate (gal/min)	10,000	12,000	22,500
Aeration (HP)	2 x 25HP 10 x 30HP	7 x 2HP 7 x 10HP	4 x 30HP
Lime Dosage (lb/day)	7,400		15,770
Average BOD_5 in Season (mg/L)	2223	1144	940
Average pH in Season	7.17	5.89	7.02
Average TSS in Season (mg/L)	504.8	498.3	592.5
Average DO in Season (mg/L)	4.33	2.62	1.65
Sludge Return (gal/min)		1,200	

* The water quality data were collected at the outlets of the ponds.

Diked Natural Wetland Treatment System

A diked natural wetland has been used for many years for the treatment of the effluent from the Lula Factory. The water quality monitoring and analyses began in October 1991. This study, which was the first done for the system feasibility, was to evaluate this particular treatment for the application of sugarcane wastewater. A masters thesis was completed by D. S. Batubara. The evaluation was based on monitoring several basic water quality parameters of pH, DO, temperature, BOD_5, COD, TSS, TVSS, TKN, ammonia, nitrate and TP, which were related to sugarcane wastewater. The system was monitored for about 6 months. Results of the monitoring and interpretation of the data were presented in the thesis. The main conclusions were:

* Wetlands could be very effective for sugarcane wastewater treatment especially for BOD, COD and suspended solids;
* Natural wetlands applied for biodegradable waste could be an inexpensive treatment

system because high technology and maintenance to the wetland system could be minimal;

* Dissolved oxygen present in the wetland system was almost zero during the season and recovered very slowly;
* Nitrification was not complete due to a lack of DO and low temperature when the monitoring period stopped in April 1992; and
* Total phosphorus removal in this particular wetland was relatively slow.

Some recommendations were made. The study suggested that a diked wetland should have enough volume to hold not only wastewater but also rainwater; the topography of the wetland should encourage the water spread evenly within the wetland; the solids flowing into the wetlands should be kept to a minimum; the recovering water should be reaerated before discharge to meet DO standards.

Anaerobic Process for Wash Water Treatment

The experiment using an anaerobic set-up was combined with previous experiment until May 1992. The data have been analyzed and a report is in preparation.

FURTHER RESEARCH WORK:

1. Continue to monitor the Glenwood and Cora Texas pond treatment systems.
2. Continue to develop a design and operational model for wash pond systems to describe the ability of a treatment system to meet DEQ discharge criteria. The model includes water quality changes due to lime addition, temperature, sedimentation, aeration and biological activities.
3. Develop a manuscript on nitrogen compound transformations and phosphorous compound changes that take place in a wetland treatment system.
4. Complete a report on anaerobic treatment of sugar mill wash water.

PUBLICATIONS AND PRESENTATIONS

Ashby, R. and D. Day. 1992. The Relative Acid Sensitivity of Gulose Compared to Mannose on Hydrolysis of Reduced Alginate. Joint Meeting, SCB-ASM and Mid South Biochemists. Starkville, MS Nov 20-21.

Bessin, R. T. and T. E. Reagan. 1993. Cultivar Resistance and Arthropod Predation of Sugarcane Borer *Lepidoptera: Pyralidae* Affects Incidence of Deadhearts in Louisiana Sugarcane. J. Econ. Entomol. 86(3):J91-376.

Bischoff, K. P., S. B. Milligan, F. A. Martin, E. O. Dufrene, J. P. Qubedeaux, K. L. Qubedeaux, J. W. Hoy, T. E Reagan, M. J. Giamalva, P. H. Dunkleman and B. L. Legendre. 1992. Registration of LHo83-153 Sugarcane. Crop Sci. 32: 1291.

Blake, A. M., D. Donze, T. Winn, D. Kim, J. Mayo and D. F. Day. 1992. Intracellular Lipid and Extracellular Dextranase Made by Chemostat-grown *Lipomyces starkeyi.* Annual Meeting ASM, New Orleans, La., May 26.

Chang, Y. S. and S. B. Milligan. 1992. Estimating the Potential of Sugarcane Families to Produce Elite Genotypes Using Bivariate Cross Prediction Methods. Theor. Appl. Gent. 84: 633-639.

Chang, Y. S. and S. B. Milligan. 1992. Estimating the Potential of Sugarcane Families to Produce Elite Genotypes Using Univariate Cross Prediction Methods. Theor. Appl. Gent. 84: 662-671.

Chen, W., and J. W. Hoy. 1992. Genetic variability within *Pythium arrhenomanes / graminicola* Complex. (Abstr.) Phytopathology 82: 1124.

Chen, W., J. W. Hoy and R. W. Schneider. 1992. Species-specific Polymorphisms in Transcribed Ribosomal DNA of Five *Pythium* Species. Experimental Mycology, 16: 22-34.

Chen, W., R. W. Schneider and J. W. Hoy. 1992. Taxonomic and Phylogenetic Analyses of Ten *Pythium* Species Using Isozyme Polymorphisms. Phytopathology 82: 1234-1244.

Clarke, S. J. 1992. In the Factory - Monthly column in the Sugar Bullentin of the American Sugar Cane League, reprinted in the Sugar Journal.

Day, D. F. 1992. Spoilage in the Sugar Industry in Brian J. Wood (ed) The Lactic Acid Bacteria in Health and Disease. Elsevier Press, London, p. 343-361.

Day, D. F., D. Kim. 1992. A Novel Process for the Production of Dextrans of Selected Molecular Sizes. ENZYME ENGINEERING XI, Annuals of the New York Academy of Sciences, 672: 573-577.

Day, C. A., M. L. Marceau-Day and D. F. Day. 1992. The Synergy Between Ciprofloxacin and Vancomycin in Treatment of Pseudomonas aeruginosa. Pseudomonas Newsletter 17 #4.

Day, D. F. 1992. The Role of Dextran in Sugar Loss to Molasses. 22nd Annual Meeting, ASSCT, St. Augustine, Fla. June 17-19.

Day, C. A., M. L. Marceau-Day and D. F. Day. 1992. The Synergy Between Ciprofloxacin and Vancomycin in Treatment of Pseudomonas aeruginosa. Joint Meeting, SCB-ASM and Mid South Biochemists. Starkville, MS, Nov. 20-21.

Giesler, G. G., A. M. Heagler, T. Baldridge, D. C. Huffman and L. Dellenbarger. 1992. Projected Costs and Returns-Soybeans, Corn, Milo, Wheat and Wheat-Soybean Double Crop, Southwest Louisiana, 1992. Projected Costs and Returns-Crawfish, Louisiana and Rice-Crawfish Double Crop, Southwest Louisiana 1992. Department of Agricultural Economics and Agribusiness, Louisiana State Univ. Agric. Ctr., LAES. AEA Information Series No. 101, January 1992.

Gravois, K. A. and S. B. Milligan. 1992. Genetic Relationships Between Fiber and Sugarcane Yield Components. Crop Sci. 32: 62-66.

Griffin, J. L., and R. J. Lencse. 1992. Preemergence Control of Itchgrass (*Rottboellia cochinchinensis*) in Sugarcane. J. Am. Sugarcane Technol. 12:65-70.

Hashimoto, K., A. M. Heagler and B. McManus. 1992. A Comparison of Rice Production: Japan and Southwest Louisiana. Department of Agricultural Economics and Agribusiness, Louisiana State Univ. Agric. Ctr., LAES. AEA Information Series No. 106, March 1992.

Hallmark, W. B., S. E. Feagley, X. Wan, and L. P. Brown. 1992. Effects of composted Municipal Waste on Sugarcane Production and Fertilizer Requirements. Sugarcane Research, LAES Annual Progress Report for 1991. p. 128-133

Heagler, A. M. 1992. Projected Cost and Returns Sugarcane, Louisiana. Department of Agricultural Economics and Agribusiness, LAES, Louisiana State Univ. Agric. Ctr., Baton Rouge. AEA, Information Series No. 103.

Hickman, P., D. Bartelt, D. Kim, J. Mayo and D. F. Day. 1992. In Vitro Studies With a Dextranase From *Lipomyces starkeyi*. International Association of Dental Research. Glasgow, Scotland, July.

Hoy, J. W. 1992. Development of a Serological Assay to Selectively Detect *Pythium arrhenomanes*. (Abstr.) Phytopathology, 82: 1115.

Hoy, J. W. 1992. Possible Causes of Weak Plant Cane During Spring, 1992. Sugar Bullentin, 70(8): 16, 20-21.

Huffman, D. C., A. M. Heagler and K. W. Paxton. 1992. Crop and Livestock Production cost Estimates for 1992. Louisiana Rural Economist, Vol. 54, No. 1, February 1992.

Johnson, J., Heagler, A. and Ricaud, R. 1992. The Economics Impact of Succession Planting and a Third Ratoon Crop on Efficiency in Sugarcane Production. Sugar Azucar, Vol. 87, No. 6, p. 41.

Kim, D. 1992. A Novel Method for the Production of Controlled Size Dextran. Thesis (PhD), Dept. of Microbiology, LSU. 1990-92.

Kim, D. and D. F. Day. 1992. Production of Low Molecular Weight Dextran Polymers by Fermentation With *Leuconostoc mesenteroides* and *Lipomyces starkeyi*. Annual Meeting ASM, New Orleans, La, May 26.

Lee, J. W. and D. F. Day. 1992. Acetylation of Seaweed Alginate by Immobilized *Pseudomonas syringae*. Joint Meeting, SCB-ASM and Mid South Biochemists. Starkville, Ms., Nov. 20-21.

Lee, Y. S. and J. W. Hoy. 1992. Interactions Among *Pythium* Species Affecting Root Rot of Sugarcane. Plant Disease, 76: 735-739.

Lense, R. J., J. L. Griffin, and E. P. Richard, Jr. 1992. Itchgrass (*Rottboellia cochinchinensis*) Control in Sugarcane With Postemergence Herbicides. J. Am. Soc. Sugarcane Technol. 12:9-15.

Martin, F. A., S. B. Milligan and L. Rodriguez. 1992. The History of Outfield Sugarcane Variety Testing in Louisiana. Sugar y Azucar 87(6): 41-42.

Martin, F. A., K. P. Bischoff, S. B. Milligan, J. P. Qubedeaux, E. O. Dufrene, J. W. Hoy, T. E Reagan, M. J. Giamalva, J. D. Miller, R. D. Breaux and B. L. Legendre. 1992. Registration of LCP82-89 Sugarcane. Crop Sci. 32: 499.

Milligan, S. B. and F. A. Martin. 1992. Evaluation Efficiency of the Louisiana Outfield Sugarcane Testing Program. Sugar y Azucar 87(6): 42.

Quisinberry, S. S., G. B. Trahan, A. M. Heagler, B. McManus and J. F. Robinson. 1992. Effect of Water Management as a Rice Water Weevil (Coleoptera: Curculionidae) Control Strategy. J. of Economic Entomology, Vol. 85, No. 3.

Ricaud, R. and A. Arceneaux. 1992. Kenaf Research on Fiber Production. Sugarcane Research, LAES Annual Progress Report for 1991. p. 164-166.

Ricaud, R. and A. Arceneaux. 1992. Cultural Practices and Soil Fertility Research With Sugarcane. Sugarcane Resarch, LAES Annual Progress Report for 1991, p. 141-153 and p. 154-163.

Sarkar, D. and D. F. Day. 1992. Analysis of Molasses and Sugar by YSI 2700 Select. An Inter-laboratory study. Report to the USNC, New Orleans, La., Oct. 1.

Saska, M., S. J. Clarke, M. D. Wu and K. Iqbal. 1992. Glucose-Fructose equilibria on Dowex Monosphere 99 CA Resin Under Overloaded Conditions. Journal of Chromatography 590: 147-151.

Saska, M., M. D. Wu, S. J. Clarke and K. Iqbal. 1992. Continuous Separation of Sugarcane Molasses with a Simulated Moving-Bed Adsorber. Adsorption Equilibria, Kinetics, and Application. Separation Science and Technology, 27(13): 1711-1732.

Schexnayder, H. P., C. A. White and T. E. Reagan. 1992. Sugarcane Borer Control, 1991. Insecticide & Acaricide Tests 17:129F

Sutherland, C., D. Adrain, M. Tittlebaum and D. Legendre. 1992. Correcting pH and Odor Problems in a Sugarcane Wash Water Treatment System. Sugar Journal V55(6): 8-13.

Viator, H., K. Quebedeaux, R. Ricaud, and A. Arceneaux. 1992. Managing For Stubble Longevity With Kleentek and Field-run CP72-370. Sugarcane Research, LAES Annual Progress Report for 1991. p. 118-121.

Viator, H. P., K. Quebedeaux, R. Ricaud, and A. Arceneaux. 1992. Managing for Stubble Longevity with Kleentek and Field-run CP 72-370. Sugarcane Research, LAES Annual Progress Report for 1991. p. 118-121.

Viator, H. P., K. Quebedeaux, and J. Hafley. 1992. Response of LCP 82-89 to Legume Cover and Cash Crops - Preliminary Report of Progress. Sugarcane Research, LAES Annual Progress Report for 1991. p. 122-127.